GAS JOURNAL

VOL. 269. No. 4624 104TH YEAR JANUARY 16, 1952

THE SIZE-EFFICIENCY RATIO

A SNAPSHOT of a steadily evolving process is apt description of 'Patterns of Organisation,' the ninth in the series of 12 reports by the Acton Society Trust dealing with aspects of nationalised industries. Previous studies have been marked by penetrating thought, broadness of outlook, and an open mind; these characteristics are pronounced in the latest report, which, after an outline of the structures and development of the nationalised industries—a very useful comparative account—is concerned with the preservation of loyalties within these industries and the incidence of size on operational efficiency. During the inter-war years the conception gained ground that large organisations are more efficient than small. The success of industries like I.C.I. was well known. Blame for technical inefficiency and duplication of effort, among other matters, was attributed in many industries to their small-scale character and parochial outlook. But the report questions how far the advantages of organisations such as I.C.I. are due to dominant position in the market rather than to operating efficiency. Disadvantages as well as advantages may accompany increase in size. It may be harder to preserve a 'sense of belonging' among employees. The machinery for managing a large group may become slow and cumbrous. Could not some of the advantages be equally well secured by a smaller body? Little research has been directed to these questions. Then there is the assumption that the public corporation is the most efficient means of public management—an assumption arrived at on 'the basis of very little evidence.' It appears to derive from the successful employment of the public corporation in organising relatively small undertakings—*e.g.*, the Port of London Authority. Does it follow that the public corporation is well adapted to handle staffs of the order of half a million spread over the country, however effective it might be in managing 'comparatively small and clear-cut undertakings such as area gas boards'? And is it really the case that public accountability can best be achieved by unifying entire industries under a single management? Such a policy has not been followed in the gas industry; and the report maintains that the machinery of accountability needs review.

The task of organising an industry is not simply an administrative one, and the limiting factor is not necessarily the capacity of management to manage. The limiting factor may well reside in the capacity and needs of the workman. The human factors—desire for status, resistance to change, fear of the future—impede the introduction of changes which the new régime was intended to bring about. Failure to recognise these factors invalidates some of the arguments for unified operation on a large scale. And 'certainly some of those who advocated nationalisation made the mistake of basing their expectations on a contrast of the theoretically possible achievements of a unified management with the actual performance of fragmented private ownership. . . . The proper pattern of nationalisation is still a matter for rational debate. . . . The feeling is gaining ground that new methods must be tried.' The boards are broadly satisfied with the nationalised structure. The report suggests that this satisfaction fails to extent to the rest of the organisation, the complaints coming from two sources—middle management and the rank and file.

It must be borne in mind, of course, that the report under review is dealing with the nationalisation structure very broadly and is not particularising on the gas industry, the organisation of which is decentralised to a marked degree compared with other nationalised industries. It is understandable that the early stages of nationalisation, during which it is necessary to bring together the operation of hundreds of previously uncoordinated undertakings and establish common procedures, may require a more centralised form of administration than may be the case later on. But the two major premises which are set out should be under-

lined. First, it seems essential that the basic units of each industry should be small enough to preserve the loyalties and personal contacts, both between management and employee and between industry and the public, upon which both happiness and efficiency must be based. What this optimum size will be will vary from industry to industry and perhaps from place to place; it is a matter which requires further research. Secondly, it seems highly probable from the experience of private industry that the co-ordination of these units can be achieved by a much looser system than at present.

FIVE YEARS' COAL PROGRESS

VESTING day for the coal industry was January 1, 1947. The National Coal Board has thus just completed its first five years of administration, and Sir Hubert Houldsworth, who last year succeeded Lord Hyndley as Chairman, took the opportunity at a Press conference in London last week of reviewing the progress made since vesting day against the background of the industry's pre-nationalisation performance, and of peeping into the future. Thanks to the efforts of the miners in recent months, the work of the railways, the mild weather experienced so far this winter, the restriction of exports, and the import of a million tons of coal from the United States during 1951, distributed stocks other than household coal are today in a healthier state than they have been for a long time. Distributed stocks of coal in 1951 amounted to 16 mill. tons, compared with 12 mill. tons in 1950, 15 mill. tons in 1949 and 1948, 16 mill. tons in 1947, and only 8 mill. tons in 1946.

Discussing the outlook for 1952, Sir Hubert said little increase can be expected from Saturday overtime working, and the manpower position cannot be forecast. On the other hand, the benefits of some of the Boards' short-term reorganisation plans are now beginning to be felt. One-third of last year's increase in output came from the five-day week; the Board hopes to do better than this in 1952. On manpower, Sir Hubert would not commit himself to any prediction, and there was a note of warning in his observation that 'with the re-armament drive getting into its swing the competition for labour in some areas is likely to become even more intense.' He hoped that the new wages agreement and the new pensions scheme would improve recruitment, though there was a possibility of losing some of the older men early in the year. The vigorous action the Board took last year to check wastage and to increase recruitment made 1951 a very different year from 1950, and the Board goes forward into 1952 resolved to be no less vigorous, and in particular to continue its efforts to build up manpower in the areas of serious deficiency.

Production of deep-mined coal rose from 181 mill. tons in 1946 to 211 mill. tons in 1951, an increase of 30 mill. tons or an average of 3% per year. The increase of only 1 mill. tons in 1950 was disappointing, largely because of the fall in manpower, and at the beginning of 1951 it looked as if competition from the re-armament drive might make the manpower situation more acute, but in the event the output was greater than expected, jumping by over 7 mill. tons. Coal consumption has risen continuously and in 1951 was 22 mill. tons more than in 1946, power stations taking 9 mill. tons more and gasworks 5 mill. tons more. Supplies of house coal in 1951 were 1.5 mill. tons higher than in 1946, but as the number of registrations had increased by 10% the amount delivered to each consumer was less. Consumption is likely to continue to grow and this, said Sir Hubert, with the present output, restricts exports; yet we must endeavour to increase our exports as quickly as possible.

Speaking of manpower, the Chairman said the industry gained 9,000 men last year against losses of 17,000 and 20,000 in 1949 and 1950. Recruitment of boys and ex-miners continued at an improved rate, but the industry needs more than 710,000 men and not all those it has are in the right places. Houses are one of the keys of the problem, and the faster they are built in the right places the sooner will the situation be mastered. Output per man year was 303 tons last year against 293 in 1950, 260 in 1946, and 290 in 1938, but it is still short of the record of 309 tons in 1937. Referring to prices, Sir Hubert said the Board has gone some way towards the establishment of a logical price structure based on heat value and other commercial considerations. House coal is now sold in eight quality groups and at uniform prices within each delivery zone. The Board began last year with £4 mill. deficit still to wipe off. By October a provisional surplus of over £3 mill. had been made for the first nine months, but the price of timber and other materials rose sharply and for the last five weeks of the year the Board carried the new wage rates without compensating increases in prices. The figures for the fourth quarter are not yet available, but they are bound to be affected by these factors. Sir Hubert told questioners that he saw no prospect of bringing coal prices down in the immediate future, but he said he would be a disappointed man if they could not be reduced in the long run.

GAS STAFF NEWS

To provide members with more up-to-date news affecting gas staffs, the British Gas Staff Association will in future produce its journal, *Thermfare*, 12 times a year instead of four. The first monthly issue (No. 21, dated January) is something of an experiment and is not necessarily in its final and regular form. It is not intended to supplant the various area news sheets, but an editorial note says that if any of the areas are so inclined and wish to discontinue their area publications it is hoped that those who have assisted in the preparation of the news sheet will let *Thermfare* have, through the organisers, the benefit of their contributions. We notice that some of the areas have been concerned about the 'unsatisfactory' operation of the recognition of prolonged, recurring, or exceptional overtime by the payment of bonuses, and the matter has been put down for discussion by the National Joint Council for Gas Staffs. The Association is also concerned at the hardship felt by pensioners the value of whose fixed income has decreased in recent years. The matter is being taken up with the Gas Council, but many legal difficulties have to be faced.

BY ANY OTHER NAME . . .

'SMOKELESS AIR'—the quarterly journal of the National Smoke Abatement Society—is a model among organs of its kind, and the current winter issue is no exception. It is well produced, easily read, and full of topical interest, much of which is devoted to the proceedings of the annual conference at Blackpool. The mood of this conference was, to those who have been in the movement for a long time (and there are many), both encouraging to the Society and of promise for the future.

Another matter which receives attention in this issue is the suggestion from certain quarters that the Society should change its name. There is, apparently, objection to the narrowness of 'smoke' and to the weakness of 'abatement'—but against this there is the familiarity of the phrase 'smoke abatement.' A decision to change one's name is not one to be taken lightly in any walk of life, and we wonder what the exponents of change would recommend by way of improvement. One school of thought, we gather, considers the name should include all atmospheric pollution; but at all costs the Society must guard against a title which produces any of those lamentable abbreviations common to some of our existing professional and other bodies. For example, while the Society for the Abatement of Atmospheric Pollution might fill the bill, the abbreviation S.A.A.P. leaves much to be desired. A correspondent points out that under section 110 (1) of the Public Health Act, 1936, smoke is defined as 'soot, ash, grit, and gritty particles,' but does not include dust not emitted from chimneys as an ingredient of smoke. The all-embracing title of Society for the Abatement of Dust, Soot, Ash, and Grit strikes us as just a little cumbersome, while the abbreviation S.A.D.S.A.G. is unfortunate. Shorter and more forceful, perhaps, is S.A.G.A. (Society for the Abatement of Grit and Ash), but less pleasing, and definitely out of keeping with the objects of the Society, is the re-arrangement to provide G.A.S.P.S. (Grit, Ash and Soot Prevention Society). Alteration is not always improvement, as the pigeon said when it got out of the net into the pie, and for our part we rest content with the comparatively euphonious N.S.A.S.

COAL ECONOMY

THE interest which has been aroused and is being displayed in fuel economy—as evidenced by leading articles and correspondence in the national Press—is a healthy sign that the need for a comprehensive fuel policy is overdue. The *Observer* of Sunday last tackled the subject editorially with emphasis of the need for installing improved types of stove for the more efficient burning of solid fuel. Savings of the order of 10 mill. tons of coal a year were suggested as being feasible by the use of new patterns of convector stove, properly fitted; and a saving of 20 mill. tons in industry was also put forward as a reasonable aim. What we need is 'a national fuel policy, designed to ensure that the various types of fuel and power are used in the fields where they are most efficient, instead of competing extravagantly.' And the point was made that, if Britain could raise her coal exports to anywhere near the pre-war level, problem would be transformed. 'The one certain hope lies in saving coal by using is more efficiently. Fuel economy . . . should be a first priority task for the Government on the home front.' In general, in these wholly necessary articles and expressions of opinion on the best use of coal, we are struck by the absence of emphasis on or even mention of the economies in coal which could demonstrably be achieved by the extended treatment of coal before use, through carbonisation and gasification.

This is exemplified by a letter by Mr. C. A. Lidbury in the *Sunday Times*, also of January 12. The letter to which we refer called attention to the part which back-pressure turbines are destined to play in any fuel economy plan—a matter which we have discussed in these columns during recent months. Mr. Lidbury mentioned that at Warrington the local Chamber of Commerce investigated a proposal for providing a heat and power station to cater for 47 factories. The matter was dropped because of the cost involved, but the writer maintained that the saving in coal would have fully justified the expenditure. The writer also brought into the picture the question of district heating by hot water from electric power stations. And here again it is unfortunately not appreciated that a gasworks is a district heating centre. It treats the coal, losing little of the coal's available heat, and transfers the gas, with little loss, to the point of use. This is elementary enough, but the crux of the matter is that the high thermal efficiency of the carbonisation process goes unheeded when coal economy is being discussed, as in the instances we have just mentioned, in a general way.

JUVENILE INTEREST IN GAS

THREE hundred boys and girls of 13 to 18 from schools in London and the Home Counties were the guests of the Institution of Gas Engineers at a Christmas lecture for juveniles at the Imperial College of Science and Technology, South Kensington, on January 4. The week after Christmas has been for many years the occasion for juvenile lectures on many subjects arranged by the learned societies and sister institutions, but this was the first time the Institution of Gas Engineers had come into the picture. We enjoyed the lecture so much that we hope it will become an annual event. It was arranged by a sub-committee—Dr. A. E. Haffner, Mr. F. Brinsley, and Mr. R. N. LeFevre—of the Gas Education Committee, whose invitation was so well received that only half of those who applied for tickets could be accommodated. The subject of the lecture was 'Flame,' and the lecturer was Mr. R. P. Fraser, O.B.E., an acknowledged expert on the subject who was responsible for a considerable amount of work during the war in connection with the development of flame throwing devices. He is associated with many projects, academic and industrial, including the leadership of a group of research workers on combustion at the Imperial College; he also lectures in the Department of Chemical Engineering. Mr. Fraser was introduced by Mr. J. H. Dyde, President of the Institution, who explained to an audience that may well have included budding gas engineers the objects of the Institution and the aims of its members. Of the lecturer, he said it would be hard to find anyone with a greater knowledge of flame, apart from the Devil himself.

Mr. Fraser, whose two-hour discourse was enlivened with experiments and exhibits, covered a field extending from a flickering wax taper to the flash in the combustion chamber of rockets which may some day be used in inter-planetary travel. He stirred the imagination of his young audience by saying that to explore inter-planetary space we must have combustion rates in rocket combustion chambers sufficient to escape from the pull of the earth. The velocity required was 25,000 miles per hour, and, to reach an orbital position so that the rocket became a satellite, 18,000 miles per hour. Apart from a wax taper, a small kerosene lamp, and a high intensity industrial fuel oil burner, all his experiments were carried out with town

gas. Passing swiftly from the nature of flame—structure, colour, and temperature—to slow moving, vibratory, and high speed (detonation) explosion flames, he ended with a summary of the uses of flame in the home, in industry, in war, and for fun. Speaking of the cool zone in the centre of a flame cone he held a box of matches in the middle of a large flame and then gave convincing proof by borrowing from a member of the audience a Treasury note which, with tongs, he held undamaged for several seconds in the middle of a flame cone. Seldom if ever have we seen the concentrated interest of an audience so completely sustained to the very end of a highly technical lecture, presented in attractive style, with plenty of practical illustrations.

STEEL FROM U.S.A.

It is reported that the United States has promised a million tons of steel for the next 10 months, together with about 250,000 tons of iron ore and metals. In return Britain has agreed to supply the United States with aluminium and has accepted a new price for tin. Britain will pay for the steel in dollars. Figures issued by the British Iron and Steel Federation on Monday show that production of steel ingots and castings last year was 15,638,500 tons, against 16,292,700 tons in 1950. Steel output in 1951 thus fell short of the April forecast of 16 mill. tons, but if the production of iron castings had not exceeded the level of 1950, and used more scrap in doing so, the steel industry would have had sufficient scrap to produce the 16 mill. tons estimated.

Personal

Mr. A. L. MacLean, District Manager, Dunblane, Perthshire, has resigned and his place has been taken by **Mr. H. Tanner,** District Manager, Auchterarder.

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Mr. G. P. Laurie, who has been 27 years District Manager in the Dunoon undertaking of the Greenock group, Scottish Gas Board, is resigning his position on medical advice.

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Mr. John R. Ratcliff, B.SC.(ENG.), M.I.MECH.E., M.I.P.E., of K. & L. Steelfounders & Engineers Ltd., has been elected to the Board of the '600' Group of Companies as Engineering Works Director.

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Mr. Basil John Smith, son of a former Chairman of the Company has been appointed to the Board of Smith Meters, Ltd. He will be principally concerned with production at the main factory at Mitcham.

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Mr. F. E. Price, F.S.A.A., a part-time member of the Wales Gas Board, has been appointed by the Minister of Housing and Local Government to be Deputy Chairman of the Cwmbran (New Town) Development Corporation.

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Mr. J. K. Barnett, Assistant Personnel and Establishment Officer to the West Midlands Gas Board, has been appointed Assistant Industrial Relations Officer at the Board headquarters. **Mr. D. V. Drake,** assistant to the Industrial Relations Officer, has been appointed Administrative Assistant, Industrial Relations Department.

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Mr. Harry Booth, Residuals Clerk, was presented on January 11 with a wallet and cheque by Mr. H. F. H. Jones, Chairman of the East Midlands Gas Board, to mark the completion of his 50 years' service with the Nottingham gas undertaking. When Mr. Booth started work as an attendant at the Radford meter house of the Nottingham Corporation Gas Department, he was paid at the rate of 4s. a week. He was later transferred to the office staff, and since 1930 has been working as a clerk in the residuals and statistics section.

Obituary

Mr. James McDonald, who was for over 20 years Gas Manager at Birnam, Perthshire, has died.

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Mr. G. F. H. Beard, General Manager of C. and W. Walker, Ltd., Donnington, Shropshire, died on January 8 at the age of 74 after a very brief illness. He was a member of the Institution of Gas Engineers, and well known throughout the gas industry. His numerous patents in gas plant are in use in many gasworks in this country and abroad. Mr. Beard began his engineering career in the works of Easton and Anderson, Erith, Kent, under the supervision of his father. He rose to the position of chief draughtsman at 21 and some time later he joined the staff of R. and J. Dempster, Ltd., Manchester, where he advanced to the position of chief engineer. In 1924 Mr. Beard was appointed General Manager of C. and W. Walker, Ltd.

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Mr. C. J. T. Mackie, Assistant Secretary of the Institution of Chemical Engineers and of the Chemical Engineering Group of the Society of Chemical Industry, died suddenly on January 8. He had been assistant Secretary of the Institution since 1924, and for 26 years he carried the whole brunt of the administration and financial work of the Institution. Until Dr. Brennan was appointed in 1950 Mr. Mackie was in charge of the office and did the whole of the work. At a meeting of the Institution on the day of Mr. Mackie's death, the President, Sir Harold Hartley, paid a tribute to his skilful administration and wholehearted devotion to his work. He had been persuaded to take a month's rest before the end of the year and returned to the office on January 7, but he died suddenly on January 8.

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Mr. David Russell, North Western District Manager of Electrolux, Ltd., died in London on January 2. Prior to joining Electrolux in 1927, Mr. Russell was in the West African cocoa trade. He joined Electrolux as a refrigerator representative at Liverpool and after a short period as branch manager at Leeds he returned to Liverpool as refrigerator manager for the North Western District. During the last war he left the Company temporarily to take up a senior executive position with Philco, Ltd., but at the end of the war he rejoined Electrolux as North Western District Manager. He was a member of the Incorporated Sales Managers' Association and of the Liverpool Branch of the Institute of Export, and served on the governing council of the Institute in London for many years.

Diary

Jan. 18.—Scottish Juniors (Western): 'Modern Coke Ovens as a Carbonising Unit,' C. W. M. Rogers (Simon-Carves, Ltd.). Royal Technical College, Glasgow.

Jan. 21.—Eastern G.C.C.: Connaught Rooms, Kingsway, 2 p.m.

Jan. 23.—London and Southern Juniors: Visit to Parkinson and Cowan, Ltd., Cottage Lane, E.C.1, 2.30 p.m.

Jan. 23.—Manchester Juniors: Visit to W. and R. Jacobs biscuit factory, Aintree, Liverpool. Short papers for the F. Johnston prize.

Jan. 23-Feb. 1—Hotel, Restaurant, and Catering Exhibition, Olympia. Gas Council stand Nos. 14, 39, and 40, Ground floor, National Hall.

Jan. 26.—Yorkshire Juniors: 'Bower Barffing and Vitreous Enamelling,' H. Whittaker (Rustless Iron Co., Ltd.). At Wakefield.

Jan. 28.—Scottish Juniors (Western District): Evening visit to Kemsley House, Glasgow.

Jan. 29.—London and Counties Coke Sales Circle: 'Trial by Jury' of a Producer Member and a Distributor Member. Holborn Restaurant. 2.15 p.m.

Jan. 31.—North Thames G.C.C.: Caxton Hall, Westminster, 2.30 p.m.

Feb. 1.—London and Southern Juniors: Development of a Temperature Limit and Over-heat Control', N. D. B. Harris (North Thames); 'The Gas Engineer and I', Mrs. Eileen Murphy (Gas Council); 'Notes on an Installation of Economic Boilers', G. J. B. Cox (South Eastern). 178, Edgware Road, 6.30 p.m.

Feb. 5.—South Eastern G.C.C.: Brettenham House, Waterloo Place, 2.15 p.m.

News in Brief

Children's Party.—One hundred and twenty young guests were entertained at the annual children's party of Bratt, Colbran, Ltd., in the canteen at Wembley on January 5. The party was organised as usual by the Social Committee, and a very enjoyable time was spent.

Le Bas Tube Company, Ltd., announce that from January 21 their head office will be at City Wall House, 129, Finsbury Pavement, London, E.C.2. They will occupy the whole second floor of this newest and most modern of office buildings erected in the City of London. Telephone: MONarch 8822 (10 lines).

Following Negotiations lasting several months, the Northern Gas Board has agreed to make a refund to Blyth Corporation in respect of street lighting costs. The Town Clerk of Blyth (Mr. E. W. Carter) has convinced the Board that his interpretation of the terms of the lighting agreement was correct and that the Council had been overcharged for lighting. The Gas Board is to make a refund of £1,500.

Cannon New Year Dance.—More than 1,500 employees and guests attended the Cannon new year dance at the Civic and Wulfrun Halls, Wolverhampton, on January 4. Modern and old time dancing was enjoyed and the gala atmosphere was evident. Coloured lights, paper hats, and prizes added to the gaiety of the scene. An innovation was the appearance of Eric Ross and his cabaret direct from London.

The Ministry of Transport has told St. Asaph (North Wales) Parish Council that unless it can prove that the conversion from gas to electricity of lighting in side streets is essential for the efficient performance of police duties they will not sanction the proposed expenditure of £1,059 required to carry out the conversion scheme. All the city's side streets are lighted by gas, and the conversion is the second stage of the changeover to electricity which started two years ago.

Theft of Coal.—At Peterborough Magistrates' Court on December 28, Donald Cliffe (29) and William McIlroy (34), of Peterborough, were sentenced respectively to six and eight months' imprisonment in connection with the theft of coal belonging to the Eastern Gas Board and to be delivered to Peterborough gasworks. The prosecution stated that large quantities of coal had been stolen and McIlroy was said to have supplied the police with 14 addresses at which he had delivered some 15 tons of stolen coal. The chairman of the Bench criticised the slackness of the Board which had made such thefts possible. McIlroy had been employed in delivering coal from the railway sidings to the gasworks and in the process had diverted quantities of coal to his own use by not completely emptying his lorries at the works.

Physical Society's Exhibition

THE Physical Society's 36th annual exhibition of scientific instruments and apparatus will be held from April 3 to 8, at the Royal College of Science main building, Imperial Institute Road, and the Huxley Building, Exhibition Road.

Present circumstances, national and international, render the exhibition of interest to all users of instruments. The re-armament programme has caused a resurgence of interest in a wide range of equipment for service use and continued need for higher productivity and increased exports has led to ever increasing developments in the field of industrial instruments.

Much new equipment has been designed for pure and applied research laboratories and much of all types of equipment is on view in the Huxley Building and the Royal College of Science.

Discourses will be delivered by eminent scientists on April 4 and 7 and the prize-winning entries of the Society's craftsmanship and draughtsmanship competition will be on show.

Coal Classification

Scientists from Great Britain, the United States, and European countries have been trying to work out an international system for the classification of coal, based on its calorific value, volatile matter, and caking properties. The object is to guide the buyer and user in finding the best coal for his purpose, and the advantages of a universal language in coal classification or description are considerable.

In their meetings at Geneva under the auspices of the Coal Committee of the Economic Commission to Europe, scientists have found difficulty in agreeing a suitable test for measuring the caking properties of coal. British, French, and Belgian scientists recently visited Holland to study the tests used there, and now a British method of assessing caking properties—the Gray King assay coke test—is being studied by Dutch and French scientists at the National Coal Board's coal survey laboratory at Sheffield.

These exchanges of views and scientific information are proving to be valuable and it is expected that an agreed international classification will be worked out.

Tar Products Film

THE *Chemical Trade Journal* comments on a lengthy documentary film, in colour, and relating to the tar distillation and tar products industries, which was recently given its first showing in Paris. The film was produced under the aegis of the Comite Intersyndical des Goudrons, Benzols et Dérivés, and is apparently one of the most ambitious projects of its type yet undertaken, its running time being over an hour.

The film covers the plant and methods at gasworks and coke ovens, the actual distillation of the tar and the recovery of the various by-products, numerous shots illustrating the use of the materials in modern industry, agriculture, medicine and daily life. Prominence is also given to certain special prepared tars including illustrations of the value of French developments in the incorporation of anthracene oils in road tars.

It is to be hoped that arrangements can be made by the British tar products industry for showing the film in this country.

SCHOOLBOYS' EXHIBITION

Above is a general view of the Gas Council's stand at the Schoolboys' Exhibition at the Horticultural Hall, Westminster, which was reviewed on page 97 of last week's issue.

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New Kitchen at Bush House

Radiation Installation will Provide 1,500 Meals per Day

The specially designed 16-ft. cooking unit which is installed in the centre of the kitchen. This comprises a five-oven Grosvenor range, bain marie, three boiling pans, each with a capacity of 8 gal. to ensure rotation of freshly-cooked vegetables, and a three-pan fish fryer.

IN February, 1951, we published a description of the new gas kitchens at the Lime Grove television studios. We now give details of another interesting installation for the B.B.C., this time at Bush House, headquarters of the European Section. A new and enlarged canteen has been opened, and again Radiation Ltd. were responsible for supplying all cooking equipment.

The kitchen and restaurant, which is designed for cafeteria self-service, is planned to handle eventually 1,500 main meals a day. At present it is staffed and equipped to operate 24 hours a day and to serve 900-1,000 main meals—*i.e.*, about 100 breakfasts, 600 lunches and 300 dinners.

The self-service counter fitted with interchangeable containers for the à la carte menu. The 'Belgravia' hot closet can be seen in the background on the left; this is employed for the transfer of hot food from kitchen to restaurant.

The kitchen is spacious and well-planned, but considerable ingenuity was required in the arrangement of equipment because the floor area is triangular. A central 16-ft. unit was specially designed to incorporate a 3-pan fish fryer, a 5-oven 'Grosvenor' range, three boiling pans complete with counter-balanced hinged lids, and a bain marie. As it was found necessary to build the unit round one of the supporting pillars, a dummy oven was included to give an unbroken working surface of 16 ft. by 6 ft. 6 in. Two 'Keswick' steamers for vegetables and puddings, a 'Savoy' griller, and a 'Belgravia' hot closet are also included in the equipment.

Two 'Belgravia' hot closets are fitted on the wall between kitchen and serving counters. The sliding doors either side ensure speedy transfer of really hot meals to the service. The 'Confector' pastry oven and a boiling table are housed in a small bay just off the kitchen.

The low ceiling in the kitchen and restaurant necessitated the inclusion of special ventilation to keep the kitchen and restaurant cool. Because the space allotted for the new canteen is underground, a great deal of thought had to be given to the decor and lighting of the restaurant. Flush fitted lights camouflage the low ceiling and the grey and primrose decorations give a restful and spacious appearance. Two or three colourful pictures, hung at eye level on the walls, enhance the inviting atmosphere of the restaurant.

CENSUS OF PRODUCTION FOR 1952

THE census of production to be taken in 1953 in respect of 1952 is to be simplified. Forms will contain fewer questions than in previous census and 'sampling' will be introduced. These changes, which have been made after consultation with the Census of Production Advisory Committee, will reduce the burden on industry very substantially and permit economy in the census of production office at the Board of Trade. The census will cover all producing industries as before and returns will be required from all firms over a certain size in each trade. A 'sample' will be taken of smaller firms, however, which means that the majority will not be required to make a return.

The statutory form of return will include questions on working proprietors, average employment during the year, wages and salaries, plant, machinery and vehicles, new building work, total materials and fuel purchased, work given out, stocks at the beginning and end of the year, total output, and transport payments.

Following are the principal simplifications compared with previous censuses: Output: Total only; Materials purchased: Total only; Employment: No detailed analysis; average number of operatives and of administrative, technical and clerical employees; Wages and salaries: No details of payments to outworkers or national insurance payments.

Any firm in the field of production requiring further particulars about the census for 1952 should write to the Census of Production Office, Neville House, Page Street, London, S.W.1.

GAS SERVICE CONFERENCE

THE following programme has been arranged for the Gas Service Conference organised by the Gas Council, to take place at Friends House and Seymour Hall, London, on March 11, 12, and 13. The conference will be opened at Friends House by the Duke of Gloucester, following which there will be an address by the Chairman of the Council, Colonel H. C. Smith, C.B.E., D.L., J.P. There will be an official luncheon on the opening day at Seymour Hall, W.1.

Session on 'Consumer Service'

Mr. H. F. H. Jones, M.B.E. (Chairman, East Midlands Gas Board), will preside at the first business session on the Tuesday afternoon, when there will be an address by Dr. E. K. Macdonald, O.B.E. (Medical Officer of Health, City of Leicester), on 'Gas and the Public Health,' followed by one by Mr. A. F. Hetherington, D.S.C. (North Thames Gas Board) on 'Service to the consumer.' In the evening there will be a reception by the Mayor and the Mayoress of St. Marylebone (Alderman F. W. Dean, D.L., J.P., and Mrs. Dean).

Session on 'Marketing'

At the session on the morning of March 12 at the Seymour Hall the chair will be taken by Mr. G. le B. Diamond, C.B.E. (Chairman, West Midlands Gas Board). An address will be given by Mr. D. R. Griffiths (Director, Incorporated Sales Managers' Association) on 'The Training of Salesmen,' and one by Mr. F. S. Evans (Coke Manager, South Eastern Gas Board) on 'The Importance of Coke to the Gas Salesman.' At 12.15 p.m. there will be adjournment for official inspection of an exhibition of gas appliances arranged by the Gas Council.

Session on 'Manufacturers and the Industry'

On resumption on the afternoon of March 12, Mr. E. Crowther, C.B.E. (Chairman, Northern Gas Board) will preside, an address being given by Mr. Richard Law, M.P., LL.D., on 'Some Problems of Appliance Manufacturers in Serving a Nationalised Industry,' with the following supporting panel of speakers: Mr. F. P. S. Stammers (Ascot Gas Water Heaters, Ltd.), Mr. F. A. Hooper (Radiation Ltd.), Mr. J. H. R. Homfray (Electrolux, Ltd.), Mr. P. D. M. Aird, T.D. (R. and A. Main, Ltd.). There will also be addresses on aspects of home service by Mrs. Eileen Murphy (ASSOC. INST. GAS E., Home Service Officer, Gas Council), Miss Mary Strong (Sales Manager, Cumberland Group, Northern Gas Board), and Mrs. Mair Jones (Chief Home Service Adviser, South Eastern Gas Board). The session will be followed by a visit of delegates to the Ideal Home Exhibition.

OFFICIAL PROGRAMME

Session on 'The Consumer and the Industry'

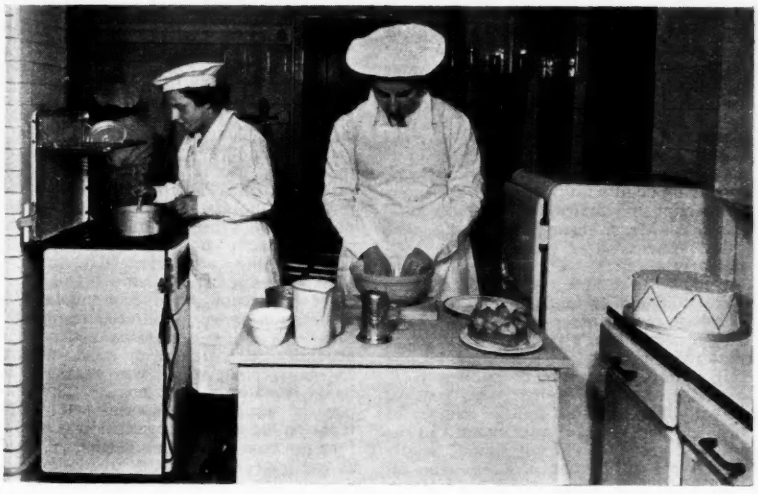
Mr. Michael Milne-Watson (Chairman, North Thames Gas Board) will preside at the fourth business session on March 13. During the morning there will be addresses by Mr. F. A. Hoare (Chairman of the Association of Specialised Film Producers) on 'Films in Industry'; by Dame Vera Laughton Mathews, D.B.E., entitled 'One Woman's Point of View'; and by Mr. D. P. Welman, (Chairman, North Western Gas Board) on 'Area Gas Boards and the National Picture.' At 1.15 p.m. there will be an official luncheon, when an address will be given by the Deputy Chairman of the Gas Council on 'The Conference in Retrospect.'

The *Gas Service* National Competition will be introduced by Mr. Clifford A. King (Managing Director, Walter King, Ltd.) and there will be presentation of awards by Colonel Smith.

Mr. R. J. Gregg (Publicity Manager, Gas Council) will introduce the Gas Council's competition for gas salesmen's circles.

Following there will be a visit to the Watson House Exhibition, while at 3 o'clock there will be a meeting of chairmen and secretaries of Gas Salesmen's Circles at Gas Industry House.

EXHIBITION OF LONDON EDUCATION



THE London County Council recently staged an exhibition at the County Hall which illustrated in a very comprehensive way the work undertaken by the Education Department of the Council.

One section of the exhibition was devoted to the teaching of housecraft, and the South Eastern Gas Board co-operated with the Council in making facilities available so that actual demonstrations of the training received by the students could form a feature of the exhibition. In a room set aside for this purpose three typical training units were displayed and two cookers, a refrigerator, washing machine, drying cabinet and ironing set was installed. Students from the various domestic subjects centres in the Council's schools attended.

In various other rooms examples of work done by trade classes and methods employed by the Council's teachers in all types of schools were displayed, and the whole exhibition gave an excellent picture of the comprehensive training available to the rising generation.

Peat-burning Gas Turbine

THE first peat-burning gas turbine in the world, now running at the Clydebank works of John Brown & Co., Ltd., was visited recently by the Scottish Peat Committee under the chairmanship of Sir Edward Appleton, F.R.S.

The plant consists of the firm's 500 H.P. experimental gas turbine, which was first run on oil four years ago and is now equipped with a peat-burning air heater and peat-drying equipment. It was designed by Parsons and Marine Engine Turbine Research and Development Association and built entirely at Clydebank. Initially, it was run on the open cycle for over 1,000 hours, but it was decided to convert the plant to a closed cycle, and it was first run on this system in December, 1949. Between then and last August 2,500 hours' running was carried out.

Speaking at a luncheon which followed the committee's inspection, Sir Edward Appleton recalled that the project was initiated when the Scottish Peat Committee was appointed in 1949 to advise on the development of Scottish peat deposits. In gas turbine research, he continued, they had seen that day the first fruits of research into burning peat in the closed cycle turbine, and that John Brown & Co., should have been able to achieve the results it had in so short a time was remarkable. Another type of peat fired gas turbine, the open cycle turbine, was being developed by Ruston and Hornsby, Ltd., Lincoln.

CONSULTATIVE COUNCILS IN SESSION

South Eastern Coal Up by Eight Shillings

Council Warned Price of Gas to be Re-examined

IF the body of Mr. R. S. Johnson's address to the South Eastern Gas Consultative Council on January 1 sought approval of the Board's work during the past financial year, there was certainly a sting in its tail. The sting, which cast a gloomy shadow across the New Year, concerned the increased price of coal which the Board will have to meet. Expressing his 'bitter disappointment at this grave news,' Mr. Johnson said that these increases would necessitate a re-examination of the price of gas. As yet he had no plan to put before the Council.

Remarking that Press statements had stated that the pithead price would increase by 5s. a ton, the Deputy Chairman revealed that the Board would have to face increases considerably in excess of that. Durham coal, which constituted the bulk of the Board's supply, would cost 7s. 11d. more. The comparatively small amount obtained from Northumberland would cost between 8s. 10d. and 9s. 2d. more. Coal from the Yorkshire fields would increase in cost by between 3s. and 8s. 5d., and that from the Kent coalfields by no less than 12s. 4d. The average increase in price of coal at pithead to the South Eastern Board would average 8s. 1d. per ton, amounting in a full year to something like £1,496,000.

Mr. Johnson, supported by Mr. R. H. Sandford Smith, Secretary, Mr. R. Prince, Chief Engineer, Mr. V. W. Stanton, Commercial Manager, and Mr. C. Stredwick, Chief Accountant, was addressing a special meeting at Caxton Hall, S.W.1, which included, in addition, members of the Council, members of the various district committees. The Chairman of the Council, Councillor A. B. Constable, presided.

As has been stated, Mr. Johnson's address was based on the report and statement of accounts of the South Eastern Board. Much of this information has already appeared in the *Gas Journal* (December 19, p. 734), and in this report it is proposed to mention only those items which have not previously appeared in our columns.

Delegation of Responsibility

In his opening remarks, Mr. Johnson referred to the Board's aim, in forming its organisation, to allow those in charge of the operational units the freedom and responsibility which they required to carry out their daily work. On the manufacturing side they had placed the station engineer in full control of all the work on his station, but had made available to him all the expert technical advice he might require. A full delegation of responsibility was particularly important on the commercial side, and in order to give prompt service to consumers the district or branch manager needed to be able to deal with all ordinary business on his own initiative and to refer as few things as possible to a higher authority. This could best be achieved by making sales and service units comparatively small, and having in one building all the activities required for normal service to consumers. The systems of organisation which were in force in the different undertakings which the Board took over did not all provide for this degree of de-centralisation, and it was taking time to make the necessary changes.

Having described the consumption of coal, coke, and oil for gas manufacture, Mr. Johnson said that further progress had been made during the year in standardising the calorific value of gas supplied throughout the area at 500 B Th.U. per cu.ft., and at March 31, 1951, 41 out of the 65 manufacturing stations were supplying at this figure. The movement towards a standard calorific value was still continuing.

New Plant

The new plant being installed and brought into operation was, he said, almost entirely that which had been placed on order before vesting date. It was satisfactory that these planned developments of the former undertakings had, with minor exceptions, been found suitable for adoption into the plan for the area as a whole. He made particular reference to the new coke oven plant at East Greenwich, and added that since its inauguration two carburetted water gas plants, each with a capacity of 3 mill. cu.ft. per day, had been brought into use to provide for daily and seasonal fluctuations in load. The coke ovens and the water gas plants were to be extended.

Having dealt with progress in the interconnection of mains, by-products, and gas sales, Mr. Johnson mentioned cooker sales. The sales of gas appliances, particularly cookers, were very well maintained, he said, and over 70,000 cookers were sold either outright or on hire-purchase during the year—an increase of 13% on last year's figures. During the first part of the year there had been a fairly good supply of new cookers from manufacturers and it had been possible to withdraw from use a large number of obsolete and wasteful appliances. In the four London divisions alone nearly 20,000 old black cookers were taken off the district and scrapped. Sales of other appliances were well maintained, but the high rate of purchase tax on water heaters and gas fires was a great deterrent to consumers.

After describing work in connection with new housing estates and Crawley New Town, Mr. Johnson remarked that in developing comparatively small district organisations for the day to day contact with our consumers it was not practical to incorporate fully the specialist staff required to deal with the needs of large commercial and industrial gas consumers. There was, therefore, a department of specialists in large scale uses of gas and these specialists were available to help and advise local staffs in dealing with large scale consumers. This service had been strengthened and increasingly used during the year; more than 200 appliances had been designed by our own staff to meet the special requirements of industry.

Mr. Johnson described the financial results as 'better than we expected.' The estimates upon which the increases in the price of gas were based assumed that there would be an increase in gas sales of the order of 2% and that certain economies would be effected in the expenses of manufacture and selling. Owing partly to the colder weather, the actual increase in the quantity of gas sold was nearly 5.7%. This increase in the sale of gas above that expected made a considerable addition to net revenue because substantially the extra expenses to be met were direct costs such as coal and other materials, without addition to fixed charges. Another reason for the results being better than the estimate was that, following a decision of the Gas Council, a different method had been adopted in dealing with hire-purchase sales. The effect had been to bring in to the credit of revenue—for this year only—an additional amount of £231,000, equal to approximately one-fifth of a penny per therm.

Provision for Depreciation

Later, still referring to the year's accounts, Mr. Johnson said that the general practice of providing for depreciation of plant was to set aside each year an amount which, by the end of the plant's useful life, would cover its original cost. This practice, of course, rested on the assumption that at the end of the plant's life another plant of the same capacity or usefulness could be bought at the same price. The substantial rise in capital costs which had taken place in recent years had made this assumption untrue, with the result that the depreciation provisions which were generally being made were much too low to enable plant which was worn out to be replaced at present prices. The purpose of setting up a special reserve for replacement and obsolescence was, therefore, to have something further in hand as well as the ordinary provision for depreciation.

Describing the important contribution which revenue received from the sale of products and from the amounts paid by consumers for the purchase of appliances for rentals and other chargeable work, Mr. Johnson emphasised that the revenue received from products was not entirely within the Board's control. The prices at which coke could be sold were, for example, influenced by the prices of comparable classes of coal and of oil. Similarly, the gas industry was only one of the industries supplying tar and

ammonia products, and the price of these products was determined by market conditions both in this country and abroad. The level of appliance sales was also not completely within the Board's control and might be restricted either by shortage of money in consumers' hands or by difficulty in obtaining supplies. In spite of purchase tax they had lately been able to maintain a high sale of appliances and secure a substantial revenue in this way.

A number of questions followed Mr. Johnson's address. The first concerned the new town of Crawley, and the questioner enquired whether the Corporation had made any contribution toward the cost of making gas supplies available to the town. In reply, Mr. Johnson explained that the project had been settled prior to nationalisation by the gas companies concerned (Croydon, East Surrey, and Horley) which had agreed to meet the whole cost of supplying gas. He thought it likely that had those companies known that their existence would continue, they might not have gone ahead. However, the Board had been quite satisfied with the scheme. Provision had been made for the Board to make application to the new town for a contribution towards the costs involved, but although the application had been duly made, no satisfaction had as yet been obtained.

Another question concerned the unrestricted sale of appliances on hire-purchase—was this fair when other traders were prevented from doing so? Mr. Johnson replied that, in his view, it was in the interests of the consumers and of the nation's fuel resources for the public to be able to obtain new appliances. The hire-purchase programme was on nothing like the scale which obtained before the war—it was not so much 'never never' as 'fairly soon'! They must restrict capital expenditure to what was available, but they must give the less well-off members of the community a chance; in any case, he believed hire-purchase to be better than hire. Every effort was made not to take an unfair advantage of other traders.

Right of Entry

And then, inevitably, the question of right of entry raised its ugly head again. The questioner, having noted Mr. Johnson's remarks on the delegation of power to the local managers, was perturbed lest they should exercise this power without warning. Mr. Johnson replied that this was a case where local authority was limited; a local manager must refer back to the commercial manager before action was taken. He fully sympathised with the view that the Englishman's house was his castle, but must point out that such powers were by no means novel; they were exercised before nationalisation in various old Acts of Parliament, now drawn together in the Gas Act. If, however, he were pressed to give an undertaking to cut down these legal powers, he would decline; it was not the Board's place to do so, and any application on the matter would have to be made through the respective M.P. But if the Board did anything which was regarded as harsh and unreasonable, they would try and put things right.

This answer clearly did not satisfy the questioner who pressed for an undertaking that notice be given in writing before any entry was made. The Chairman, however, promptly closed the matter, and attention then focused on a question regarding the function of the Board's Research Department, and whether the Board contemplated making its own appliances. Mr. Johnson, having described how close liaison was maintained with the manufacturers on all technical matters, said it was a brave man who would prophesy a long distance into the future, but although the Gas Act gave boards the power to manufacture their own appliances, he saw no reason to start exercising that rule at the present time; on the contrary, there was advantage in being able to look to a number of makers.

Other questions dealt with included the examination of consignments of appliances and the differing methods of rating employed for the Gas Board and their electrical competitors. Further questions were refused by the Chairman on the grounds of insufficient time.

East Midlands Hint of Dearer Gas

BECAUSE of the rising cost of coal and other charges, the East Midlands Gas Consultative Council at its meeting at the Victoria Station Hotel, Nottingham, on January 1, was informed that consumers may be called upon to pay more for their gas from the end of the March quarter.

Mr. C. R. Bates (Chairman of the Council) gave this information when he read a letter from the Secretary of the East Midlands Gas Board, Mr. A. Gwynne Davies, drawing attention to increased costs incurred by the Board since a statement made by the Chairman (Mr. H. F. H. Jones) to the Council on November 6 last.

The November statement pointed out that the new tariff should bring in an increased revenue of about £1¼ mill. instead of £1 mill. estimated to be realised by the 10% surcharge now in force, leaving a nominal deficiency of £15,000 in a full year after allowing for a contribution of £100,000 to the reserve fund. Since the above statement was completed the Board had been notified of increases in the cost of oil and petrol amounting to £25,000 in a full year, and of a national wages settlement for manual workers costing about £150,000 a year.

The letter continued that a more accurate calculation had been made of the cost of the national wages settlement referred to, and information had also been received as to increases in freight charges and the price of coal which took effect from December 31.

These increases, together with certain set-offs from increased revenue, were shown as follows:

	£
Increased annual cost of petrol and oil dating from October 29, 1951	23,000
Gas workers' wages as from the first pay week in November, 1951	159,000
Wages and salaries of graded staff and intermediate grades as from January 1, 1952	58,000
Railway freight charges as from December 31, 1951 : Coal	98,000
Other materials (including coke)	20,000
Increase in price of coal as from December 31, 1951	466,000
Coke oven gas consequent upon price of coal	150,000
TOTAL	974,000
Against this it is hoped revenue from coke will increase by £200,000, plus provision from anticipated coal price increase already made £142,000	342,000
Estimated total increase in costs	£632,000

There had also been substantial increases in the cost of practically all materials purchased by the Board, and the effect of these was now being studied.

The letter added the Board had not come to any decision as to the variation in tariffs which would be required to recoup the increased expenditure which had arisen. It had been hoped that the new tariff would have remained in force for a period of at least six months before any variation became necessary. It now seemed probable that some alteration would have to be made as from the end of the March quarter, and further information would be submitted to the Council when the Board had given the matter full consideration.

Representations were received from the Lincoln County Borough Council with reference to the increase in the price of gas at Lincoln where, it was contended, they had been unfairly affected by the Board's new tariff zoning scheme.

A letter from the city's Town Clerk was read maintaining that the prices at Lincoln had been increased more than any other area in the East Midlands. It was claimed that the undertaking had been built into an efficient unit while owned by the Corporation and now they were being asked to subsidise less efficient areas.

Councillor J. W. Giles (Lincoln) said the feeling in Lincoln was that under the new zonal tariff the increase had been imposed where it was least deserved. In Lincoln gas had previously been produced at one of the lowest prices in the country and had still made a handsome profit. Today they felt they were being penalised.

Mr. H. F. H. Jones (Chairman of the Board) said it was not denied that zoning must include some slight degree of subsidisation of smaller units by bigger undertakings. Lincoln had not been unfairly picked upon, and the Board was always ready to consider representations from any area that considered itself unfairly treated. The Board had given the Council an assurance that after zoning had been in operation its working would be reviewed and any errors would be discussed with a view to revision.

(*Concluded on next page*)

OPPOSITION TO OXFORD GASWORKS EXTENSION

OXFORD City Council on January 7 unanimously approved the recommendation of its Planning Committee that permission should be refused to the Southern Gas Board for an extension of the existing gasworks on the river Thames frontage. During the discussion the question of possible liability on the city for compensation was raised.

The Planning Committee's report said that in the remote event of compensation becoming payable it would represent the extra cost of building the gasworks extension elsewhere than adjacent to the existing works; it would be grant-aided to the extent of at least 30% and would be subject to a loan repayable over a period of years. The committee said that the Board's estimate of £500,000 for this extra cost was thought to be much exaggerated and would, if necessary, be expertly examined.

Councillor A. B. Brown, Chairman of the Planning Committee, said the matter was of national as well as of local importance; if the question of compensation arose it would have to be fought. Councillor W. C. Walker said the Finance Committee hoped that compensation would not be payable but the Government would be strongly pressed on the point if the need arose.

Alderman E. A. Smewin said that while many people were prepared to accept the removal of the gasworks, not all of them agreed with the alternative site at Cowley. They would sooner see the gasworks go 'somewhere out in the wilds.'

Reading-Oxford Main Completed

Mr. O. R. Guard, Chairman of the Southern Gas Board, stated on January 7 that the new high pressure gas main from Reading to Oxford had been completed. The main is intended to take 2 mill. cu.ft. of gas per day as a supplementary supply to relieve the pressure on the Oxford works.

The laying of this main at a cost of £200,000, and over a length of 18 miles from Reading to the outskirts of the Oxford high pressure distribution system, has been carried out by the Southern Gas Board in an effort to prevent any immediate danger to Oxford gas supplies, the demand for which has been increasing so rapidly in recent years. By the end of January it will be possible to pass 1 mill. cu.ft. of gas from Reading to Oxford daily, and towards the end of the year the full 2 mill. cu.ft. a day, for which the main was laid. This is an increase of about 25% upon the present capacity of the Oxford works.

Fuel Team for America

A British team is going to the U.S. on January 31 under the auspices of the Anglo-American Council on Productivity to study fuel conservation.

Mr. W. L. Boon, of Powell Duffryn Technical Services, Ltd., is to lead the team and Mr. W. J. Dickie, of the Federation of British Industries, will be its secretary.

Furnace industries and those depending largely on coal as a raw material are excluded from the enquiry and domestic heating will be studied only so far as its demands impinge on the electricity peak load.

The tour will take in diverse power installations in a variety of industries, and ancillary equipment will be studied. There will be conferences with American associations dealing with coal, gas, and petroleum.

The team will make recommendations for economising in existing resources and for a long-term policy for using fuel in Britain.

Gas Service Centre.—Following its policy of giving improved service to consumers, the North Western Gas Board has opened a new gas service centre at Barnoldswick, Yorkshire, where the new building will meet a long-felt need. The centre was opened on December 5 by Councillor W. A. Smith, J.P., Chairman of the Barnoldswick Urban District Council, who was welcomed on behalf of the Board by Mr. Harry Butters, Board member. Barnoldswick is the most easterly of the Board's 103 undertakings, and the only one in Yorkshire. It forms part of the Burnley group.

EAST MIDLANDS CONSULTATIVE COUNCIL —

The Secretary of the Council (Mr. D. G. Robinson) was instructed to write to the Lincoln Council informing them of what had transpired at this meeting on the matter.

The Council also heard a complaint from the Ilkeston Town Council concerning the inadequate maintenance of the gas street lighting. It was stated that of 719 street lamps in the town 15 were out of order when the report was compiled.

Mr. Jones said the management was the same at Ilkeston as before vesting date. The difficulty was that they had inherited small supply pipes there and the undertaking had been overloaded. He did not believe things there were any worse than before. The complaint had been referred to the Board.

Minutes of the Sheffield and Rotherham Divisional Committee revealed that Mr. E. H. Harman (General Manager of the Sheffield and Rotherham Division) had reported that if the Board was allowed to carry out the planned development of the Sheffield district it was hoped that by 1955-56 the daily output from Sheffield would reach a target of 95 mill. cu.ft. per day. In this connection it was desirable that industrialists should inform the Board of their future requirements of gas.

It was confirmed that negotiations were taking place for the acquisition of premises for new gas showrooms and offices at Gainsborough.

The Directors of Powell Duffryn, Ltd., announce an interim ordinary dividend of 3% actual, less tax, on the £9,660,471 ordinary stock in respect of the year ending March 31, 1952, payment to be made on February 23.

CHRISTMAS PARTIES IN MANCHESTER

CHRISTMAS parties for employees' children have been a regular feature in Manchester ever since 1929. The parties are financed jointly by profits from the works canteens, by the welfare fund, and private donations. Large numbers are the rule, not the exception; this past Christmas, for example, more than 400 children went to Bradford Road works party to be entertained at tea and a wide range of amusements, including a concert and a Punch and Judy show. Visitors included Councillor C. E. P. Stott, J.P., Chairman of the North Western Gas Consultative Council, and Mrs. Stott, and Mr. John Wilson, General Manager of the Manchester group, and Mrs. Wilson. Our photograph was taken at the Bradford Road party.

Sulphate of Ammonia Propaganda

BRITISH FEDERATION REPORTS NEW WORLD RECORDS

THE 31st annual report of the British Sulphate of Ammonia Federation, covering the year ended June 30, 1951—the 54th of propaganda work undertaken successively by the Sulphate of Ammonia Committee, the Association, the Federation, Nitram, Ltd., and Imperial Chemical Industries, Ltd.—shows a continuance of the upward trend in both production and consumption of nitrogen in the world generally, but a fall in British home agricultural consumption and in British exports.

World production of fixed nitrogen for all purposes rose by about 5% to a new total of 4,972,700 metric tons. Production and consumption of industrial nitrogen increased by 17%. Agricultural consumption, estimated at 4.29 mill. metric tons, exceeded the previous year's figure by 12% and was slightly above the output for the year. Working stocks accumulated in previous years were thus further reduced. Several plants in various countries planned to start during the year under review will not commence production until this year.

Table I, which expresses world production and consumption of fixed nitrogen in thousands of metric tons of pure nitrogen for 'fertiliser years' ended June 30, is compiled from the published information available regarding production and consumption in all countries.

The total United Kingdom production of nitrogen products in the calendar year 1950 was 6.2% higher than in 1949. Output of fertiliser products fell by 2.6% but there was an increase of 40% in industrial forms. The figures in Table II are based on deliveries against sales within each fertiliser year. As in 1950, farmers placed orders for large quantities for delivery in May and June, 1951, prior to the increase in prices rendered necessary by the removal on July 1 of the remainder of the subsidy on fertilisers. It is estimated that the cumulative carry-forward to the 1951-52 season may thus have amounted to 30,000 tons nitrogen, and that on this basis actual usage was 206,335 metric tons in 1950-51 and 205,660 tons in the previous year.

The year 1950-51 is described in the report as one of the most difficult in living memory for farmers. Bad weather in the autumn caused substantial losses at harvest and also prevented the sowing of autumn wheat in many parts of the country. Continuous rain in the spring seriously lessened the sowing of spring wheat and forced farmers to sow a much larger acreage of barley than had been planned. The result of these misfortunes was a reduction in the acreage of wheat and potatoes and a concomitant decrease in the use of sulphate of ammonia on arable land.

The quantities in the first tonnage column show the total production of nitrogen products expressed in terms of a standard material containing 25% ammonia = 20.6% nitrogen. The last column shows tons of sulphate of ammonia actually produced with a nitrogen content varying from 20.4 to 21.1% nitrogen.

A further adverse factor was the substantial increase in the cost of sulphate of ammonia and other fertilisers due to the removal of part of the subsidy in July, 1950. In these circumstances a considerable reduction in the use of nitrogen might have been expected. The fact that consumption was maintained is largely due to the growing appreciation by farmers of the importance of grass as a crop, and of the fact that the use of nitrogen on grassland—even at the higher cost—means a large saving in the replacement of imported and other feeding-stuffs.

There has been a substantial increase in silage-making and grass-drying, and in the use of nitrogen to obtain early and late grazing. Imperial Chemical

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TABLE I.

WORLD PRODUCTION AND CONSUMPTION OF FIXED NITROGEN FOR ALL PURPOSES
(In thousands of metric tons)

	1950/51		1949/50		1948/49	
	Production	Consumption	Production	Consumption	Production	Consumption
EUROPE (*a*)	2684.4	2460.3	2436.7	2213.0	2067.4	1954.3
Belgium/Luxemburg	181.0	84.5	182.9	84.9	172.7	76.3
France	269.0	285.6	234.3	250.3	195.0	250.9
Germany—W. Zones	516.9	400.7	497.4	368.4	377.2	377.5
Netherlands	189.1	169.5	113.6	146.2	86.8	117.6
Norway	167.0	42.0	153.0	42.1	112.0	30.8
Italy	177.6	170.0	137.0	138.6	120.2	125.4
U.K.	382.4	301.3	361.8	276.4	356.0	248.9
Other Europe (*a*) ...	801.4	1006.7	756.7	906.1	647.5	726.9
ASIA (*b*)	482.4	691.3	470.5	745.6	372.1	636.8
China and Formosa...	15.1	83.0	10.4	66.1	4.7	42.2
India and Pakistan	9.7	86.2	11.3	73.6	9.6	51.8
Ceylon	—	13.3	—	12.3	—	10.7
Japan proper ...	455.0	436.0	386.4	442.5	301.2	378.6
Other Asia (*b*) ...	2.6	72.8	62.4	151.1	56.6	153.5
AFRICA	19.5	177.1	18.6	149.7	17.4	123.4
Egypt	0.7	115.6	0.2	96.4	0.2	75.7
Other Africa ...	18.8	61.5	18.4	53.3	17.2	47.7
OCEANIA	13.5	27.9	11.9	22.8	12.6	18.4
AMERICA	1772.9	1666.1	1791.5	1323.0	1686.8	1248.1
U.S.A. (*c*)	1322.0	1511.9	1328.0	1201.9	1214.0	1141.5
Canada	180.0	52.5	190.0	44.6	189.8	39.1
Chile	265.7	12.1	270.9	14.3	280.8	12.2
Br. West Indies ...	—	7.5	—	7.3	—	8.3
Other American ...	5.2	82.1	2.6	54.9	2.2	47.0
TOTAL WORLD ...	4972.7	5022.7	4729.2	4454.1	4156.3	3981.0

(*a*) Incl. Eastern Zone of Germany and U.S.S.R. (*b*) Incl. North Korea and Manchuria.
(*c*) Incl. Hawaii and Puerto Rico.

TABLE II.

PRODUCTION OF NITROGEN PRODUCTS AND SULPHATE OF AMMONIA IN UNITED KINGDOM

(Long tons of 2,240 lb.)

Calendar Year		Included in the Total	
		Industrial Ammonia Products	Sulphate of Ammonia as such
1939 ...	856,800	263,900	483,300
1947 ...	1,408,600	291,200	796,700
1948 ...	1,648,800	355,100	901,000
1949 ...	1,691,100	358,800	924,500
1950 ...	1,803,400	505,000	960,700

HOME AGRICULTURAL CONSUMPTION IN UNITED KINGDOM

Fertiliser Year	SULPHATE OF AMMONIA Long tons of 2,240 lb.	NITROGEN FERTILISERS (Metric tons of 2,204.6 lbs.) NITROGEN CONTENT IN		
		Sulphate of Ammonia	Other Forms	Total Nitrogen
1923/24	128,000	26,800	7,600	34,400
1930/31	142,400	29,800	10,400	40,200
1938/39	179,800	37,600	23,000	60,600
1943/44	664,041	138,981	42,771	181,752
1944/45	612,381	128,169	44,305	172,474
1945/46	552,202	115,574	48,889	164,463
1946/47	551,208	115,366	48,700	164,066
1947/48	632,916	132,467	52,943	185,410
1948/49	593,779	124,276	60,828	185,104
1949/50	748,115	156,577	69,083	225,660
1950/51	706,900	147,951	68,384	216,335

MAKING COAL WORK HARDER . . . . . *A Constructive Plan of Action*

AN interesting addition to the Conservative Political Centre's Discussion Series is 'Make Coal Work Harder,' an immaculate little booklet by Gerald Nabarro and C. J. M. Alport. The former is M.P. for Kidderminster and a specialist in industrial fuel problems; the latter, M.P. for Colchester, an expert on imperial affairs and Director of Political Education to the Party. The authors emphasise that their booklet is not a technical treatise; but believing that it is technically possible to achieve a saving of coal which will revolutionise the present economic prospects of the United Kingdom, and greatly improve the standard of family comfort, they set out in broad outline the lines along which they think we should progress. That the present problem of fuel shortage can only be solved by 'a gigantic effort of self-discipline and technical achievement' in no way deters them.

Before considering the remedies they suggest, it might be as well to refresh our memories concerning the fuel situation as it is at present. In 1950 we mined 204 mill. tons of coal and in 1951 we may raise the figure to 215 mill. tons; both figures are exclusive of opencast output. There appears to be little chance of raising deep-mined output much above 215 mill. tons per annum, for despite mechanisation the output of coal per man-year is today slightly below that of 1940. In 1951 total consumption was 7 mill. tons more than in 1950; stocks are low, and the electricity expansion programme alone reckons on needing an extra 2¼ mill. tons of coal each year for the next 15 years. This keeping pace with power house expansion will, by 1965, rocket the coal needs of the electricity generating industry from 33 mill. tons annually to 66 mill. tons. Thus demand continues to outrun production. What is to be done?

Fifteen-Year Plan

The nationalised coal and electricity planners propose to spend £1,645 mill. over the next 15 years to increase coal and electricity output. But this is unlikely to do more than give industry the extra coal it must have if industrial productivity is to rise high enough to balance our overseas payments; it will hardly provide the 33 mill. tons required by the power-house expansion.

On this dismal prospect Messrs. Nabarro and Alport build their theme. Coal is a wasting asset, they say, so would it not be more prudent, more profitable, and more businesslike to devote a substantial part of our capital funds and resources to a great national drive to ensure the efficient use of fuel and power? Quoting the view of fuel technologists that industry could save certainly 20 mill. tons per annum within five years and perhaps eventually 50 mill. tons given urgent and resolute scientific direction and Government support for an energetic and comprehensive industrial fuel policy, they reach the conclusion that the ordinary factory is an even worse offender than the power station.

The factory, then, is their first objective and the authors put forward several suggestions for improving its fuel efficiency. Steam production for heating and processing results in the thermal efficiency of the coal used being about 20%. The electricity used in most factories is fed to the grid from a generating station with a thermal efficiency of, perhaps, 25%. Thus the average factory consumes coal directly or indirectly at only 22½% average thermal efficiency. Back-pressure power generation with reciprocating engines and turbines, which can increase the thermal efficiency to something like 70%, is expensive. Therefore the authors suggest that the Treasury might allow the cost of this plant to be charged against profits as a revenue item of expenditure—a sort of interest-free loan of immediate advantage to the nation. Other improvements suggested include the improvement or replacement of inefficient boilers, adequate lagging of steam pipes, the installation of private generators (and the suppression of B.E.A. hostility to this procedure), heat insulation of buildings, and the augmentation of the skeleton fuel economy advisory service of 175 technicians working under the direction of the Ministry of Fuel and Power by a panel of private fuel consultants who would co-operate on a five-year plan to overhaul all coal-burning equipment in the factories of their respective areas.

The second part of the booklet is devoted to fuel efficiency in the home. The authors quote the estimate of experts that the fuel saving possible on the domestic front is 10 mill. tons annually; 6 mill. of this would be saved by the installation of improved solid fuel equipment in 8 mill. homes. This equipment, they suggest, would be within the economical reach of most people if mass production methods were employed, and they mention the possibility of giving a small subsidy or tax remission as an incentive. They go so far as to suggest that steps be taken to eliminate certain appliances, if possible by agreement with the manufacturers. For the rest they preach the usual sermon on wasteful practices, and stress the importance of local authorities' and architects' co-operation. And, of course, they make a 'party,' point by criticising the 'ineffective and half-hearted' and the 'purely negative' approach of the Socialists.

No Mention of Gas

The curious thing about the booklet is that it makes almost no mention of the gas industry; it is as though our industry did not exist. The efficiency of the carbonising process and the claims of gas as an economical force in the home and (more particularly) in the factory, are ignored. While agreeing with many of the points put forward by the authors, the enlightened reader is bound to be disturbed by this lop-sided view. By omitting mention of the gas industry the whole argument suffers. It says much for 'Make Coal Work Harder' that we have devoted so much space to outlining its message. The fact is that despite its considerable failings, it does present a constructive plan of action, and that alone is something of moment in these frustrated days.

SULPHATE OF AMMONIA REPORT — (*Concluded from previous page.*)

Industries, Ltd., while continuing scientific researches on the problems of grass production and conservation, arranged a large number of demonstrations on a farm scale throughout the country. In these endeavours I.C.I. had full support and much practical help from the National Agricultural Advisory Service.

Sir James Scott Watson, C.B.E., Chief Scientific and Agricultural Adviser to that Ministry, presided over an important grassland conference at the I.C.I. Dairy House Farm in Cheshire, which was attended by over 400 leading British grassland farmers and technicians, and by many agriculturists from overseas.

New publications were distributed during the year, and no less than 60,000 copies of a booklet entitled *Grassland* were called for.

The work of the research department continued, special attention being paid to the question of materials of construction. Experiments on the use of resin cements and lacquers for protective coatings against attack by both acid and alkaline liquors were intensified and a fair measure of success has been achieved.

Since 1934-35 a discount of 1s. 6d. per ton per month has been allowed on the spring price for taking earlier delivery. From 1940-41 to 1950-51 prices to farmers were 'pegged' and producers received a subsidy on home agricultural sales to cover increases in cost not included in the price. To cover increased railway freight rates prices have been advanced by 13s. per ton over the past five years in four stages—July, 1946, 1s.; October, 1947, 5s.; May, 1950, 4s.; and April, 1951, 3s. As from July 1, 1950, part of the subsidy on fertiliser was removed and the pegged price to farmers increased.

United Kingdom exports of sulphate of ammonia in 1950-51 were 14% less than in the previous year. During the year the Board of Trade continued to control the allocation of all forms of nitrogenous fertilisers exported from the United Kingdom. India, Pakistan, and Burma, previously the largest buyers of British sulphate of ammonia, purchased only 16,051 tons against 47,369 tons in the previous year. Britain's best customer was Ceylon, which took 36,000 tons, about its average for recent years, and next in order of quantity were British West Indies 31,467 tons (against 29,247), Malaya and British Borneo 17,046 tons (against 16,454), Australia and New Guinea 14,999 tons (against 31,401) and South Africa and Rhodesia 14,611 tons (against 10,104).

Membership of the Federation, whose Chairman is Mr. F. C. O. Speyer, was increased by two to 75 during the year.

TREATMENT OF GASWORKS LIQUOR

By W. H. BLACKBURN, Ph.D.
(Gas Research Board), and
T. G. TOMLINSON, M.Sc., and T. H. SUMMERS,
(Water Pollution Research Laboratory, Department of Scientific and Industrial Research).

The following is an abstract of Publication GRB 63 of the Gas Research Board, 'The Treatment of Gasworks Liquor in Admixture with Sewage in Percolating Filters,' presented at the 1951 Research Meeting of the Institution of Gas Engineers. Our report of the discussion is included.

DURING 1949, in view of the increasing urgency of the gas industry's problems associated with the disposal of effluents, the Council of the Gas Research Board arranged to increase the volume of research work. New work was started upon the separation and identification of the organic components or groups of components in crude gas liquor involving a new technique described in this paper. Through Dr. Southgate, Director of Water Pollution Research, arrangements were made for biological experiments to be carried out in percolating filters treating domestic sewage. Results of these are also described in this paper. The work is being continued in order to determine new methods of treatment of effluent to avoid, if possible, the discharge of components which might interfere with sewage treatment.

Three factors have brought the problem of gasworks liquor disposal into greater prominence: (1) Increase in the loads imposed on sewage-treatment plants; (2) increases in and centralisation of gas production, increasing in some districts the ratio of gasworks effluent to sewage flow; (3) new legislation on pollution leading to the setting up of river boards with powers to impose standards for effluent discharged to surface waters.

Spent Liquor in Percolating Filters

Work began with large-scale experiments of comparatively short duration on the treatment of gasworks liquor at Leamington sewage works and with an investigation of the processes of biological oxidation and the effects of different constituents of the liquor on sewage purification. The investigation described in this paper is an extension of that work. It started in 1947 when a small sewage-disposal works at Stivichall, Coventry, was placed at the dosposal of the Water Pollution Research Board. The plant consists of two circular percolating filters in which experiments have been carried out on the effect of known concentrations of gas liquor on the treatment of settled sewage of purely domestic origin.

It was decided that one part of the research programme should be directed to the identification and estimation of the constituents present in the liquor. This was recognised to be a long term investigation and in the meantime it was decided to divide the liquor into a number of fractions (not necessarily pure compounds) and to observe the effect of each fraction separately on sewage purification. A method of fractionation has been devised and the effects of each fraction on sewage purification have been investigated in small scale plant, comprising eight filters with dosing apparatus erected at Stivichall.

Both sections of the work at Stivichall have been carried out by the Water Pollution Research Laboratory in collaboration with the Liquor Effluents and Ammonia Committee of the Institution of Gas Engineers and more recently with the Advisory Panel on Ammonia Effluents of the Gas Research Board. The work on fractionation has been done in the Gas Research Laboratory of the University of Leeds.

At Stivichall, Coventry, the sewage is entirely domestic and is fairly fresh when it reaches the works. After screening, it flows to a sedimentation tank; settled sewage passes to a gauging tank with a Lea recorder and thence through automatic siphons to two circular percolating filters in parallel. Filter effluent is settled in a humus tank and discharged to form the head of a small stream. The filters are both 39 ft. in diameter by 6 ft. deep with ½ in. broken granite filtering medium and four-arm rotary distributors. The effective diameter of both filters was reduced to give an average daily rate of application of about 70 gal. of sewage per cubic yard of medium.

The rate of addition of spent liquor to the settled sewage is governed by an automatic device which ensures that the liquor flows to the supply pipe only when settled sewage is passing the filter. A sample was taken of settled sewage when this, with or without gas liquor, was passing to the filter, and samples of effluent every half hour. Analyses of these were made two or three times a week and samples of the gas liquor were analysed at Leeds. From April, 1948, to May, 1950, spent gas liquor from Coventry gasworks was used. It was then decided to use a more typical spent liquor with a lower free ammonia content; this was obtained from Leamington gasworks and was used from May to December, 1950. Results of analysis of different batches of liquor used, when amounts of 0.4% to 0.5% by volume were being added to the sewage, are tabulated. Samples of spent liquor from Coventry showed wide variations of free ammonia, from a maximum of 2,360 parts per mill. to a minimum of 220 with a mean of 917 from September, 1948, to May, 1949. The fixed ammonia was more even with a mean of 3,050. The mean figures for September, 1949, to February, 1950, were 1,285 and 3,100 respectively. Spent liquor from Leamington from May to October, 1950, showed means of 200 free and 3,160 fixed ammonia. This liquor contained an average of 2,250 parts per mill. thiocyanate and 2,290 phenol. The total oxygen absorbed from permanganate in four hours at 26.7°C. was 10,620, which included 4,070 due to phenols, 4,390 from thiocyanate, and 'difference' 10,620.

Preliminary Results

The programme of experiments started with the two percolating filters, A & B, both treating settled sewage only for four months. Filter A then continued to treat settled sewage from April 8, 1948; spent gas liquor from Coventry was added to the settled sewage passing through filter B in concentrations increased by stages from 0.1% to 0.5%, at which figure it was maintained for seven months. In June and July, 1949, both filters ran on settled sewage alone, and then the increasing dosage was applied similarly to filter A except that from May to December, 1950, the spent liquor came from Leamington.

The results are tabulated. There was very little difference in the effluent between 0% and 0.1% liquor. The effect of adding 0.5% liquor on the biochemical demand of the sewage was usually small and not always consistent, but that on the B.O.D. of the settled effluent was more marked and consistent, reaching as much as 100% during the winter. That proportion of liquor from Coventry increased the permanganate demand of the settled sewage by about 50%; Leamington liquor increased it slightly more. Taking the data as a whole, the addition of 0.5% gas liquor increased the permanganate demand of the settled effluent by about 50%.

The discharge of suspended solid matter from percolating filters operated by single filtration usually varies with the activity of scouring organisms, generally reaching a maximum in the late spring. The results in this respect are shown in

graphs. The general impression obtained from these biological observations is that gas liquor has an effect similar to that which would be expected from an increase in the strength of the sewage. The effect on colour is also graphed. Colour quality (tint) was little affected by 0.5% liquor. The presence of liquor tended to make the colour of the effluent redder and resulted in an appreciable increase in colour intensity though by no means uniformly.

Fractionation of Crude Gas Liquor

Existing knowledge of the effect of the constituents of gas liquor on sewage purification when Dr. Key's book, 'Gasworks Effluents and Ammonia,' was published in 1938, is briefly summarised.

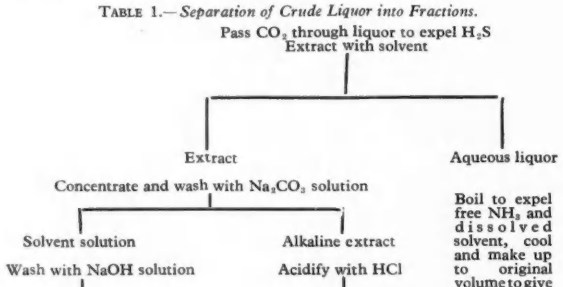
The term 'higher tar acids,' bracketed with 'polyhydric phenols,' 'colour-producing bodies,' as undesirable constituents of liquor, seems to have been first used in the 60th Annual Report on Alkali, etc., Works, 1923. The quantity is estimated by the burette aeration test, but this is not regarded as an accurate measurement of higher tar acid content, although a useful indication of the type of liquor, because some higher tar acids—*e.g.*, resorcinol—do not absorb oxygen under the conditions of the test. Another method of assessment is to use the 'difference' figure in the permanganate oxygen absorption balance. But since this figure represents the oxygen value of all the organic constituents other than monohydric phenols and includes all the experimental errors, it can only be regarded as an indication of higher tar acid content in certain cases. A large proportion of the higher tar acids in liquor are polyhydric phenols—*e.g.*, catechol, resorcinol, and homologues. It is shown in the paper, however, that a small proportion have characteristics different from these and it is proposed to discontinue the use of the term 'higher tar acids' in favour of more precise terms indicating the type of compounds present in addition to the simple monohydric and dihydric phenols.

General Plan of the Investigation

A relatively simple scheme was devised to separate the constituents of the gas liquor into a number of groups of compounds by processes involving the minimum of physical loss and chemical change, no attempt being made to isolate pure compounds, and then to determine the effect of each group separately on sewage purification. A number of small scale experimental percolating filters were erected and operated on domestic sewage for sufficient time to ensure that there was no significant differences in their efficiencies and then the fractions of the gas liquor were added to the sewage and the effects observed.

Previous methods of chemical separation are briefly described. In the present investigation the fractionation was carried out in the manner indicated in Table 1.

TABLE 1.—*Separation of Crude Liquor into Fractions.*


Pass CO_2 through liquor to expel H_2S
Extract with solvent
Extract
Aqueous liquor
Concentrate and wash with Na_2CO_3 solution
Boil to expel free NH_3 and dissolved solvent, cool and make up to original volume to give
Solvent solution
Alkaline extract
Wash with NaOH solution
Acidify with HCl
Caustic extract
Solvent solution containing
Solution
Precipitate
Acidify and extract with solvent to give
Extract with solvent to give
PHENOLS (Fractions A, B, C, D)
NEUTRAL OILS AND BASES (Fraction E)
'CARBOXYLIC ACIDS' FRACTION
'HUMIC ACIDS'
TREATED LIQUOR (Fraction G)
(Fraction F)

Contrary to previous methods, at no stage of the operations was the liquor made strongly alkaline or acid. As it was the intention to use the 'treated liquor' as one of the fractions in the biological experiments it was considered important that in the course of the removal of the organic material from the liquor other changes should not occur—the addition of caustic soda would liberate all fixed ammonia and a mineral acid would destroy the thiosulphate. Moreover, it was found that the additional material which could be extracted from the liquor by making it successively strongly alkaline and strongly acid was very small.

Another novelty was the removal of the carboxylic acids first, by washing the solvent extract with sodium carbonate solution, with subsequent removal of the phenols by washing with caustic soda solution. Each alkaline extract was immediately acidified with HCl with the important advantage that the phenolic material remained for only a short period in strongly alkaline solution.

It will be noted in Table 1 that in fraction F a precipitate was formed. This had an odour quite distinct from the carboxylic acids; it was provisionally classified as 'humic acids.' There was no clearly defined separation of phenols from carboxylic acids in this method; the latter were, in fact, accompanied by considerable amounts of phenols and are therefore classified as the 'carboxylic acids fraction.'

It was decided that it was most important that all operations should be carried out in an oxygen-free atmosphere. When ammoniacal liquor is exposed to air its colour darkens and it is evident that some change in its composition occurs. It is also known that some of the dihydric phenols—*e.g.*, catechol—are easily oxidised and it is probable that other compounds present are similarly affected.

The properties desirable in the ideal solvent are discussed. From the results of previous work, *methyl isobutyl ketone* was chosen as possessing many of the desired properties and used in most of the work. In some earlier experiments and occasionally afterwards for special cases, di-ethyl ether was used.

The Solvent Extraction

Crude vertical retort liquor was obtained from the Meadow Lane gasworks, Leeds, in 10 gal. carboys and CO_2 was passed through it for several days to remove most of the H_2S. Special apparatus was erected for washing large volumes of the liquor in the absence of air. The atmosphere used was CO_2, which gas, at a pressure of 5 lb. per sq. in., was used to pass the liquid from one vessel to another. The apparatus is shown in Fig. 1.

The liquor is passed first into carboy A and thence through the glass tap B into the 75 litre glass vessel C fitted with a motor-driven stirrer. The stirrer shaft D was fitted with a ball bearing and mercury seal E near its upper end and a graphite block bearing F at the bottom. A volume of solvent equal to 15% of the volume of the liquor was added through the tube G, and the contents of the vessel were then intimately mixed for 5 min. A sufficient period was allowed for separation, usually about 15 min., and the washed liquor was then returned to the carboy A and the solvent containing dissolved extract to carboy H. The liquor was then returned to the mixing vessel for further washing.

The usual treatment was to wash the liquor five times with solvent so that the total volume of solvent used was 75% of the volume of liquor. This ratio of solvent to liquor is, of course, greater than that used in a commercial plant for the recovery of dihydric phenols from liquor but was necessary in order to extract those constituents which had less favourable partition coefficients than the dihydric phenols.

The solution of the extract in solvent was concentrated in the solvent recovery plant shown in Fig. 1, to about 3% of its original volume. The amount of liquor which could be washed in the laboratory per day was found to be very largely determined by the rate at which the solution of extract could

be distilled, and rather than increase the size of the flask beyond 5 litres it was decided to erect the distillation apparatus in quintuplicate.

Distillation was carried out at an automatically controlled pressure of 150 mm. of mercury in order to reduce the temperature to which the extract was subjected and to make it possible to heat the flasks in water baths, thus reducing the fire hazard.

The separation of the solvent extract into groups of compounds is described. The carboxylic acids and humic acids were separated out first by washing with sodium carbonate solution, the latter being precipitated and dried out. The phenols were recovered from the extract in a similar way except that caustic soda was used instead of sodium carbonate. Subsequently these were divided in a fractionating column into a large number of fractions, but for use in the biological experiments these were re-grouped into four fractions: A, phenol; B, cresols and xylenols; C, catechol and homologues; D, resorcinol and homologues. Fraction E, obtained by distilling off the solvent after the extraction of phenols, consists of neutrol oils and bases, and fraction F consists of the liquor after washing with solvent, boiled to remove dissolved solvent at the same time expelling free ammonia.

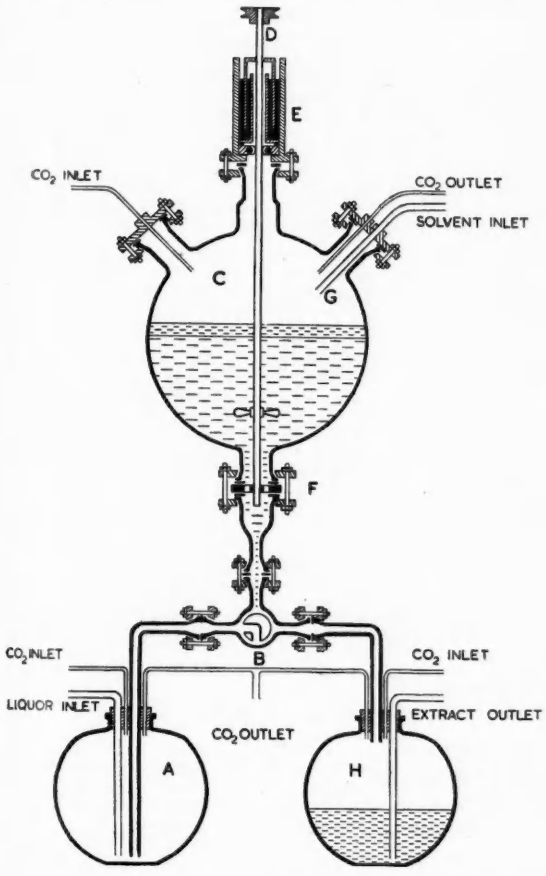


Fig. 1.—Apparatus used in the Solvent Extraction of Crude Gas Liquor.

The weights of the several fractions in grammes per litre of crude liquor as supplied to the filters were A, 1.21; B, 2.63; C, 0.96; D, 1.15; E, 0.15; F, carboxylic acids 0.61, 'humic acids' 0.09.

The eight experimental filters, each 1 ft. dia. by 6 ft. deep, were erected at the Stivichall sewage works, Coventry. Settled sewage from the gauging chambers of the works filters is pumped to a distribution chamber from which it is supplied to the experimental filters by means of eight motor-driven dosing valves. The method of mixing and dosing is described in detail. The whole plant is contained in a wooden hut fitted with controlled heaters which come into action when the temperature falls below 18°C, the minimum observed being 7.5°C.

The mean concentrations of the gas liquor fractions in the settled sewage expressed as equivalent amounts of crude gas liquor percentage of sewage averaged over the period of the tests from 1.76% to 3.00%. The observed increases in oxygen absorbed values and of the biochemical oxygen demand caused by the additions of the different fractions are tabulated. The former were nearly the same as would be (arithmetically) determined from the oxygen absorbed values of the separate fractions. The B.O.D. of the sewage was not materially altered by fractions D, E, F, and G; it was increased by 42.5% by fraction A (phenols), 47% by fraction B (cresols and xylenols), and 15% by fraction C (catechols).

Mean values for oxygen absorbed from permanganate by influent sewage with and without the addition of the several fractions of gas liquor and by the settled effluents are tabulated, with similar figures for biochemical oxygen demand. Considering the former first, it is shown that fractions A, B, and E had least effect—on some occasions they did not exert any significant effect—fractions C and D had a greater effect, and fractions F and G the greatest. Fraction G approximately doubled the permanganate demand of the effluent; fraction F had somewhat less effect at first but had a greater effect than G in the later periods. Fraction E had the least effect on B.O.D.; fractions A, B, C, and D had very similar effects; fraction F had a slightly greater effect and except during the last period fraction G had by far the greatest effect of all. The concentration of thiocyanate was reduced in the effluent from the filter treating fraction G to a very small figure.

Fraction F had the greatest effect on both the quality and intensity of colour of the effluent (not surprising since fraction F has an intense brown colour); fraction G similar; fractions C and D tended to make it redder and to increase the intensity. None of the fractions had any apparent effect on the flora and fauna of the filters.

Discussion of Results

Fractions A and B, containing monohydric phenols, and fractions C and D, consisting mainly of catechol, resorcinol, and homologues, all increased significantly the oxygen demand from the filters; fractions C and D had a slightly greater effect than A and B on the oxygen demand from permanganate but the effects of all four fractions on B.O.D. of effluents were about the same. It appears that in the proportions in which they occur in this particular liquor the polyhdric phenols were of only slightly greater importance than the monohydric.

When the practice of hot de-tarring of crude gas is adopted and when in addition the retort house liquor is disposed of separately, the content of 'higher tar acids,' as measured by the burette aeration test, is very substantially reduced. It is claimed that the liquor then obtained (after recovery of part or all the ammonia) has much less effect on treatment of sewage than has spent liquor where hot de-tarring is not used, and it has generally been assumed that this difference was due to the reduction in amount of polyhydric phenols. The results which have now been obtained do not support this assumption.

A new fact which has come to light in the present work is the importance of fraction F, carboxylic acids and 'humic acids,' the effect of which is generally slightly greater than A, B, C, and D. 'No evidence is put forward on the relative importance of (the sub-divisions) carboxylic acids and humic acids and it is proposed in future experiments to try the effects of these two groups of substances separately. Some preliminary experiments have indicated that, when hot-gas de-tarring is used and *the retort house liquor is disposed of separately*, 'humic acids' are not present in the crude liquor, and it may well be that, in spite of the relatively low concentration of this constituent in normal liquor, its exclusion is the most important effect of hot de-tarring.'

Fraction G had a more marked effect on purification than any of the other fractions and in addition it interfered to some extent with nitrification. It seems probable that much of this effect is due to thiocyanate—a point to be investigated in future experiments. Of all the fractions, E containing neutral oils and bases had least effect on treatment of sewage.

The present work has been on the treatment of spent gas liquor; experiments are now in progress on the treatment of liquor from Hinckley gasworks where hot gas de-tarring is in operation and where the retort house liquor is excluded from the (other) crude liquor.

DISCUSSION

Dr. J. G. King (Director, Gas Research Board) remarked that it was part of the general programme of work at Dr. Southgate's laboratory to study the effect of trade effluents on sewage and in streams and the fact that he had made available to this gas industry project not only his experience in such matters but also the experimental facilities described in the paper must mean accelerated progress towards a solution of one of the gas industry's serious problems.

Dr. Southgate had given him a written contribution as follows:—

'The Water Pollution Research Laboratory has always taken a particular interest in the treatment of gas liquors. As a result of the work of the Institution a great deal was discovered about the nature of gas liquors and their effects on sewage treatment and about modifications which can be made, at least at some gasworks, to reduce the difficulty of treating the liquors. For example, the early work showed that thiocyanate is one of the constituents of gas liquor which is difficult to treat at a sewage works, and recent work has confirmed this. In spite of the improvements which have been made in recent years, however, it would be agreed—certainly by those engaged in the business of treating sewage—that much further information is required. It is generally held, for example, that effluent from the treatment of a sewage containing gas liquor is more highly coloured than that from a purely domestic sewage, and this may be quite important in some circumstances; it has also been suggested that gas liquor in sewage causes frothing of effluents and may affect the physical properties of the humus discharged from filters. Moreover, some of the methods adopted by the gas industry to deal with the problem of disposal require further study. There is a good deal of evidence to show that hot de-tarring of gas reduces the difficulty of treating the gas liquor. This has usually been attributed to a reduction in the concentration of polyhydric phenols, but the information which we have on this point is by no means conclusive, and the present paper seems to show that polyhydric phenols may not be so difficult to treat by biological means as has been supposed. It may be that the important effect of hot de-tarring is to remove some other substances—for example, what have been called in the present paper "humic acids"—which are the real cause of the trouble. It is clear, however, that much remains to be done before questions of this kind can be answered with certainty.

An Example of Co-operation

'It is very encouraging that there is now such close contact between the gas industry and those responsible for treatment of sewage, which contains so large a proportion of the industry's waste liquor. We at the Water Pollution Research Laboratory hope that the work will be continued and expanded and that in time other organisations —for example, universities—will take a hand in it. It is quite certain, for example, that a fundamental study—of the kind that can best be made in a university—of the chain of reactions whereby constituents of gas liquors are decomposed by bacterial action would be of great interest not only to those hoping to improve methods of treating gas liquor but to the bacteriologists themselves.'

Dr. King went on to say that collaborative work should be developed to the fullest extent possible. Dr. Blackburn was doing valuable work on the separation of the components of gas liquor, and he might want greater help later if he developed new methods for separating the components of gas liquor under conditions which prevented any change whatever in those components. There was reason to suspect that the methods which he was using now were causing some change, so that the reconstituted liquor had not quite the same effect as the original liquor.

Dr. S. H. Jenkins (Chief Chemist, Birmingham Tame and Rea Drainage Board) commented that during the past few years there had been a growing improvement in the relationships between local authorities responsible for sewage purification and those who represented the gas industry. This had been due to a large extent to a greater appreciation and perhaps a franker statement of one another's problems. Dr. Jenkins went on to say that in a well established process like gas manufacture, especially when the process was carried out on the scale on which it was carried out at Coventry, the loss of raw material, which was, after all, what the figures of oxygen absorbed represented, would be reasonably stable; but instead of that they found that the variation was from 40%, below the average to 45% above the average. The uninitiated might be excused for believing that at a smaller works differences of this magnitude might be expected; yet if they looked at the figures given for the Leamington gasworks they would notice that they were remarkably stable, the variation being only from 6% below the average to 6% above the average.

Losses at Typical Works

In this connection there was a matter with which he thought the Gas Research Board might well concern itself—namely, to examine critically the sort of losses which occurred at typical works and to try to find means of preventing these enormous variations, because certainly a local authority faced with an application to receive gas liquor from a works, and knowing that variations of such magnitude would occur, would take steps to prevent the sewage works from suffering the overload which such variations would cause.

The paper could be divided into three parts. There was the work at Stivichall, there was the work which had been carried out at Leeds on the fractionation of gas liquor, and there was the work that was being carried out on the effect of these different fractions on sewage purification by filters.

From the paper it would be seen that the addition of 0.5% of gas liquor to the sewage had only a small effect—almost a negligible effect—on the biochemical oxygen demand, whereas it increased the impurity content of the sewage by about 50%, if measured by the oxygen-absorbed test. In regard to the effect of this addition of gas liquor on the effluent, they would find that, both by the oxygen absorbed test and by the biochemical oxygen demand test, the impurity was approximately doubled. The period in question was the most important period during the winter. If, however, they looked at the thiocyanate figures they would notice that they were very small. They were not sufficiently large to account for the increased amount of impurity in the effluent caused by the addition of the gas liquor. If the authors had given them the full composition of those effluents and determined the phenol, the thiosulphate, and the sulphide, all these would have been found to be too small to affect appreciably the amount of organic impurity in the effluent.

Preferential Oxidation

It was important to try to find the reason for the increased impurity in the effluent as a result of the addition of the gas liquor. He would put forward one view—namely, that by feeding sewage on to a filter one established a biological population which was inadequate to deal with the sewage which represented the food for the organisms. He would suggest that, on the addition of gas liquor, the gas liquor constituents were oxidised preferentially by the bacteria, so that the sewage matter passed through only partially oxidised. There was an alternative view which he thought had already been put forward—namely, that the gas liquor constituents were themselves toxic, and, according to recent views on chemical toxicity and bacteria, it was assumed that the chemicals combined with the enzyme systems upon which the bacteria depended for all their vital processes and thereby allowed some of the other substances in the sewage to escape oxidation.

There was a third view, which Dr. Blackburn had put forward and which perhaps might receive some support—namely, that gas liquor contained substances which were so resistant to biological oxidation that they passed through the filters unoxidised; but he had a little difficulty in accepting that view at the present time, because he did not see how a substance which escaped biological oxidation by filtration could actually be measured by tests which were themselves biological, unless

of course, it was assumed that these substances which escaped oxidation were actually toxic. That was a matter which the authors would do well to pursue.

Continuing, Dr. Jenkins remarked that two years ago he mentioned that the authority which he represented, in collaboration with the West Midlands Gas Board, was carrying out experimental work on the purification of substances present in gas liquor. These experiments were carried out quite independently of those reported in the present paper, and in many ways they were complementary. They had found that small amounts of phenol and catechol, up to 20 parts per mill., could be oxidised in the presence of sewage with only a very small—almost a negligible—effect on purification. As soon as the amount of phenol was increased beyond that concentration—say up to 40 parts per mill.—the effluent began to suffer in quality. Thiosulphate was easily oxidised. They too had found that thiosulphate had a marked effect on the purification of sewage, and it was interesting to note that, although the thiocyanate might be completely oxidised, the effluent which was obtained was unsatisfactory when measured by ordinary sanitary tests.

They had experimented with a number of gas liquors, for instance, 0.25% of ammoniacal liquor, 0.33% of spent liquor, 0.625% of Hinckley liquor, and also with the Hinckley liquor to which had been added the higher tar acid removed from the tar precipitated in the process. They had found that this higher tar acid fraction alone seriously affected the quality of the effluent, and it had the same effect when added to the Hinckley liquor.

Recently they had started to build up a synthetic gas liquor, beginning with small amounts of thiosulphate and thiocyanate and also with thiocyanate and phenol, and as soon as they had been assured that these constituents were being oxidised they would continue to add further constituents. They expected that this work would have to go on for at least another three years before they were in a position to make any conclusive report on the matter.

The Leeds Programme

Dr. H. Hollings, O.B.E. (Chairman of the Advisory Panel on Ammonia Effluents, Gas Research Board), remarked that the Panel was active and enthusiastic, ready to go to any place where any new research work could be seen. He went on to speak of the programme of work at Leeds. About two years ago they made a general review of where the research on effluent liquor had led. The work had been going on for some years, and it was perhaps a little surprising to some that they should reach the decision at this time that what was most needed was a precise analysis of the ammoniacal liquor. But not enough was known about the composition of the liquor to permit any further development of research, so Dr. Blackburn started the precise solvent extraction analysis which he had described. At the same time they were conscious of the need for expediting some practical results, so, instead of waiting for the final results of the analysis, the preliminary fractions obtained by Dr. Blackburn had been submitted to the practical trials described by Mr. Tomlinson.

Dr. Blackburn had explained the way in which his results were confirming or modifying some of the earlier findings of the Institution Committee, and he directed particular attention to the significance of the thiocyanate content of the liquor.

Continuing, Dr. Hollings said that members of the Institute would be interested to learn that quite recently the Gas Council Research Committee had decided that this work should be extended, and it had arranged for financial support to be available for a new research to be started at Leeds. The Panel would be meeting Professor Huckle, the Professor of Biochemistry at Leeds University, and would be discussing the detailed programme of an entirely fresh biochemical approach to the problem of oxidising some of the individual constituents which it was being shown were particularly resistant to treatment in the ordinary sewage oxidation process. His own view was that the work in this field of biochemistry in the next few years might be quite exciting, and he thought that the gas industry was fortunate to have secured such willing collaboration from experts in so many different fields.

Middlesex Experiments

Mr. W. T. Lockett (Chief Chemist, Middlesex County Council Main Drainage Department) said that it might be of interest if he described briefly some experiments carried out a few years ago at the Middlesex County Council Mogden sewage works. They were really a continuation of the early Manchester experiments and those of Dr. Key relating to the bacterial oxidation of phenol and thiocyanate. They differed from previous experiments in that they were carried out with activated sludge in a very high state of activity, capable of completely converting the ammoniacal nitrogen of sewage into nitrate in the course of a few hours. In one series of experiments mixtures of sewage and phenol were treated and in the other series mixtures of sewage and thiocyanate. Sewage containing the required amount of phenol or thiocyanate was mixed with the activated sludge, and the mixture was aerated until the ammonia of the sewage was completely oxidised in each case. The mixture was settled and the supernatant water was removed from the settled sludge, and then the sludge was used for dealing with another batch of sewage containing phenol or thiocyanate, as the case might be. As time went on, the proportion of phenol or thiocyanate was increased.

It was ultimately found that it was possible to treat a mixture of sewage containing 80 parts of phenol (C_6H_5OH) in the course of about 24 hours. It was found possible also to treat in this way sewage containing 80 parts of thiocyanate (expressed as CNS), but in this case the time required was rather longer. The latter experiments were the more interesting. There was some difficulty in the initial stages in getting the sludge acclimatised to treat thiocyanate, and it was necessary at the beginning to use sewage containing only 1 part of thiocyanate. Subsequently, it was found that the thiocyanate was removed from the solution in the course of a few hours, but that a considerably longer time was required for the oxidation of the intermediate products of the reaction. The reaction was essentially a breakdown of the thiocyanate to ammonia, sulphur and, presumably, carbon dioxide. The sulphur was finally oxidised to sulphate and the ammonia was nitrated.

The results of these experiments indicated (1) that if thiocyanate was to be successfully treated bacterially the process of oxidation should be taken virtually to completion; (2) that the deterioration of a filter dealing with rather more sewage and gas liquor than it could satisfactorily treat would be rapid, and (3) that gas liquor along with sewage could be dealt with best in sewage plants producing nitrified effluents.

In the early Manchester experiments it was shown that the presence of nitrate facilitated the bacterial oxidation of sewage. This observation also indicate that gas liquor along with sewage could best be dealt with in sewage plants producing nitrified effluents.

Regarding the biochemical oxygen demand results, which have caused some controversy, Mr. Tomlinson had mentioned that the biochemical oxygen demand of sewage plus 5% gas liquor was not appreciably higher than the biochemical oxygen demand of the sewage itself. He would suggest that the reason for that was that the organisms in the particular mixture in question were not acclimatised to treat the particular constituents of the gas liquor. These organisms actually put up a stubborn resistance at first to oxidation. He remembered that, in one experiment, when the bacillus responsible for the oxidation of phenol was not isolated from the filter there was no difficulty in oxidising the phenol, but when a culture of this organism was brought from another source it was about three weeks before they could induce it to deal with phenol, after which time there was no difficulty in the oxidation of the phenol. Therefore, he thought that if the authors added a little of the effluent from the filter dealing with gas liquor and sewage they might be able to get some biochemical oxygen demands results similar to those which they expected.

Economics the Controlling Factor

Dr. A. Marsden, M.B.E. (Area Scientist, South Western Gas Board), remarked that the first section of the paper dealt with the effect of vertical retort liquor on sewage, and he thought that this was very good choice, because, if they accepted the figures given by Dr. Key in Table 2 of his book 'Gasworks Ammonia and Effluents' (second printing, page 8), liquor from continuous vertical retorts represented a more difficult case, and, if the problem could be solved for the vertical retort liquor, presumably it would also be solved for horizontal retort liquor.

Personally, he always found it difficult to get away from the view that it was wrong to dispose of untreated liquor, particularly when one considered that ammonia and sulphur were being lost at the same time. It was, of course, well known that economics represented the controlling factor, with transport very high on the list, but he thought that, as integration proceeded and the number of small works diminished, it would become increasingly possible to process liquor econo-

mically and, with the possible adoption of new processes, such as Mr. Cooper mentioned, to produce effluents which could be disposed of at a reasonable charge. Whether they liked it or not, the time had come when effluents will be accepted only if they conformed to certain definite standards.

The step taken in 1949 by the Advisory Panel on Ammonia Effluents was very important, because it set the problem on a more scientific basis and now, instead of the liquor being looked upon as a whole, the question of the nature and behaviour of individual constituents, particularly the thiocyanate and the phenolic bodies, had been investigated. The fractionation of the liquor constituents is of particular interest and, when attempting to compare their respective behaviour, one was immediately confronted with the question of which was the most satisfactory test to apply that would also bear some close or constant relation to biochemical happenings in the sewage mixtures. His point was that the oxygen absorption test would appear to fall short of the information required, and it was pleasing to know that serious attention was being given to this point.

In fact, the authors had drawn attention to the danger of assessing the higher tar acids in a liquor from the 'difference figure' in the permanganate oxygen absorption balance, because the figure represented the oxygen absorption of all the organic constituents, other than monohydric phenols, and, of course, it included all experimental errors.

Again, the burette aeration test could not be regarded as measuring accurately the higher tar acids, because, although catechol in alkaline solution under the conditions of the test absorbed oxygen, resorcinol did not do so. All this led to the further question of what higher tar acids were.

Higher Tar Acids

This matter could be looked upon from various points of view. Sewage disposal technicians might consider the relative slowness of oxidation of higher tar acids and their colour-producing properties as the most important points. They knew that tar distillers looked upon them entirely from the point of view of their high boiling points, although the distillers preferred to call them 'higher boiling tar acids' (B.P. 240°C. to 340°C.), because they distilled after the xylenols. Chemists might view them from the number of hydroxyl groups present although accepting the fact that all phenols must have the hydroxyl group or groups attached directly to the benzene nucleus. There was one point that emerged—namely, that the terms 'higher tar acids' and 'polyhydric phenols' were not strictly interchangeable, because the higher tar acids might contain polyhydric phenols. In fact, one could and did refer to the polyhydric content of higher tar acids. Therefore, as the authors suggested, the term 'higher tar acids' would have to be replaced by a more precise term which would indicate the type of compounds present, and until this was done ambiguities would arise.

Hot gas de-tarring was effective in causing a considerable reduction in the higher tar acid content in the liquor. In other words, there was a redistribution of the phenolic bodies between tar and liquor, but, in that connection, there was one point which was not quite clear to him. The author stated: 'When the practice of hot de-tarring of crude gas is adopted and when in addition the retort house is disposed of separately. . . . . .' He wondered what precise method of disposal they had in mind.

Factors with a Common Aspect

Mr. M. Lovett (Chief Inspector, Yorkshire Ouse River Board) remarked that three factors had in recent years intensified the impact of the gas liquor problem—namely, the increased load now being carried by many sewage treatment plants, the increase in gas production and the centralisation of gas making, and the new pollution prevention legislation. Those three factors had a common aspect in that all of them were related to the problem of the prevention of pollution of rivers and streams. In the past, the magnitude of the gas liquor problem had to a large extent been directly proportional to the degree of activity shown by the river authority in the particular locality concerned. Now, for better or for worse, the country had been covered by river boards whose activity was assured.

It was now generally accepted that gas liquor could be treated in admixture with domestic sewage, subject to certain limitations, which from an operational point of view were also generally accepted. A curious notion used to be held by a few that the biological plant on a sewage works treating domestic sewage only could treat the same volume of sewage with the addition of 0.5% of its volume of gas liquor without deterioration in the quality of the effluent. He had not heard that view expressed in recent years, and he assumed that it had been discarded. The plain fact was that for the quality of the effluent to be substantially maintained additional biological oxidation capacity must be provided, and this meant the outlay of capital.

Several attempts had been made to assess the extent of this additional outlay. One approximate illustration would be to say that the percolating filter capacity required for the treatment of 1 gal. per day of spent liquor would be the same as for the treatment of the sewage of two persons, the capital outlay being at least £3. For crude gas liquor the cost might be almost double that; so cost was an important item, whether it was borne by the gas undertaking or by the ratepayer. In either case the cost was borne by the community.

The Burden of Cost

Although his entire professional life had been spent in river pollution prevention work, he could not help agreeing with the view expressed by other speakers that pollution prevention by the biological or other destruction of recoverable material was economically unsound at any time, especially in the times through which they were passing. He thought it could justifiably be argued that the cost of production (to the community) of such materials as ammonia and phenol must take into account the high cost of destroying those substances (for pollution prevention purposes) in those cases where recovery, though at first sight economically unattractive, was none the less practicable.

The impact of the investigations recorded in the paper, continued Mr. Lovett, might be much more significant than what the authors described as their ultimate object—the elimination of those substances which had the greatest effect on treatment—in that the 'difficult' fractions when defined might possibly be worth intensive study from the point of view of by-product recovery, or, alternatively, that the residues from by-product recovery, or some of them, would not unduly disturb sewage treatment. This might not necessarily be the case, but, if it were so, treatment costs would be reduced in two directions at once, and that would be a most attractive prospect.

The important point was that the problem was being tackled and with increasing tempo, and this was undoubtedly a matter on which congratulations were due to the Gas Research Board and the Institution. The river inspector was sometimes in an awkward position, since it was the stream for which he was responsible that stood to suffer. He recalled one instance—in fairness it must be admitted that it was in pre-nationalisation days—in which, when complaint was made of liquor reaching the stream, it was discreetly discharged to sewer, and, when the sewage works manager complained, it was discreetly diverted back again to the stream—an economical if not entirely laudable system of disposal. What was the poor gas-works manager to do, or the poor sewage works manager, or the poor river inspector? Fortunately, a reasonable solution was found, though not before tempers became a little frayed, and no doubt the river inspector was soundly cursed behind his back, if not to his face. But did not this show to what an extent they were all—the gas industry, the sewage undertakings, and the river boards—involved?

The British Thomson-Houston Co., Ltd., in a review of 1951, states that its factories operated to capacity within the limits imposed by restricted raw materials and availability of labour. Extensions, together with the development of new methods and techniques, increased the Company's manufacturing potential. Output of electronic equipment was greater than in any previous year and the demand for standard commercial lines far exceeded the available supply. All the electrical equipment for the world's largest walking dragline, built by Ransomes and Rapier, Ltd., for Stewarts and Lloyds, Ltd., at Corby, was manufactured by B.T.H. Much important work was done for new N.C.B. collieries and for similar enterprises overseas. Important orders for turbo-alternators were fulfilled during the year, and orders for compressors and exhausters included one of the first centrifugal refrigerating compressors to go into commission in this country for British Celanese, Ltd., at Spondon. The Company is supplying electric motors for new projects in the chemical industry and new plant for oil refineries.

A. W. SANDERS,
Assistant Works Engineer,
Aylestone Road Works,
describes the new

Midland Junior Gas Association
Meeting, December 11, 1951.

GAS-MAKING PLANT AT LEICESTER

IN 1944-45 it became imperative to secure further extensions to carbonising and ancillary plant at the Aylestone Road works, Leicester. Sanction was obtained for the acquisition of gas-production plant which would give an increased make of 6 mill. cu.ft. per day.

Orders were placed for the following major items:—

Carbonising plant, 6 mill. cu.ft. per day, West's Gas Improvement Co., Ltd.; Power Gas Corporation, Ltd.

Coke-handling plant, Mitchell Engineering Co., Ltd.

Condensing plant, 7 mill. cu.ft. per day, W. C. Holmes & Co., Ltd.

Exhausters, 12 mill. cu.ft. per day, W. C. Holmes and Co., Ltd.

Electro-detarrers, 8 mill. cu.ft. per day, Whessoe Ltd.

Ammonia-washers, 8 mill. cu.ft. per day, W. C. Holmes & Co., Ltd.

Purifier conversion, C. & W. Walker, Ltd.

The sixty-four 50-56 in. Glover West continuous vertical retorts are in eight beds, each of eight retorts, and are further divided into two ranges each containing four beds. The retorts are in heating units of four, and employ the balanced heating system. Zoning of heat over the length of the retort is achieved by alteration of the size of the CO nostril. Control of secondary air is by similar method. Control of the expansion of the brickwork is entrusted to spring-plates, in conjunction with the steel bracing normally employed.

From each retort, short ascension and descension pipes lead into collecting mains situated at rodding platform level. A totally enclosed and positive acting gas valve is used at this juncture to isolate individual retorts and is equipped with a simple locking device to retain it in the closed position. Each retort is equipped with a sector discharger, which is individually operated by a hydraulic jack, fed with oil at a pressure of 2,000-2,400 lb. per sq. in. The retorts on each bed are under the control of a cyclic controller which evenly spaces out the cutting of each retort throughout the cycle in use. Control of the cyclic period is accurately carried out by an electronic timing device, and it is easily possible so to stagger the eight cyclic controllers that retorts cut at approximately equal intervals of 40-50 sec. It is possible to 'hand-cut' any single retort at any time, out of sequence. The isolation of any retort is readily executed by the operation of a simple semi-rotary control. Each range is regarded as a separate installation having its own duplicate electrically-driven hydraulic pump unit. Total enclosure of all moving parts is aimed at, together with the removal of the pumping machinery from the atmosphere of the retort house. An audible alarm is to be fitted to draw attention to any serious fall in hydraulic pressure.

Each range is heated by two producers, with a fifth producer acting as standby. Each pair of producers is supplied with air by its own electrically driven fan. A steam turbine driven fan acts as a standby and is sufficiently large to feed four working producers.

At the outlet of each producer a centrifugal type of dust extractor is installed from which the producer gas is delivered into a bus-main. From here each bed draws its supply, half of which passes through a horizontal CO flue set in the lower courses of brickwork between the retorts. It is in this way that the CO for balanced heating is supplied to each side of the setting.

Sectional isolation of the CO flue and isolation of individual producers are effected by the use of stainless steel slip plates which are inserted between flanges in the main and drawn up together.

Control of CO pressure in the bus-main is by Askania oil-servo regulating gear of the latest type, equipped with interlocking and overtaking gear.

A rotary ash bowl, actuated by Lockheed hydraulic grate drive, discharges producer refuse on to an underground band conveyor which delivers into a fully automatic skip-hoist. This delivers the ashes into a 15-ton hopper arranged for the loading of lorries.

The unusual step was taken of installing in the coke feed system to the producers a cutter through which all coke over 2 in. is passed. All coke then passes over final static screens of 1¼ in. mesh, so that within the limits of efficiency of the screens the producers are fed with clean coke graded 1¼ in. to 2 in. Coke is conveyed to each producer by an electrically propelled skip which is weighed over an Avery automatic indicating and integrating machine.

Instrumentation has been planned from three aspects: (i) Producer gas; (ii) waste gases and waste heat recovery; (iii) crude gas stream.

Indicating and recording instruments register pressures, temperatures, and rates of flow throughout each producer unit. Audible and visible alarms are arranged on each producer to draw attention to the need for recharging with coke, while a warning light indicates the closed or open position of the top charging door. Pull and temperature conditions are indicated and recorded at the inlet and outlet of each waste heat boiler, while a CO_2 recorder can be operated at different points along the waste gas main. Boiler control is assisted by the installation of steam pressure, temperature, and flow recorders in the outlet stream main from the retort house. Pull conditions, and rate of flow of crude gas are recorded, while temperature is indicated.

Although a certain amount of centralisation of instruments has been carried out (*e.g.*, a central instrument panel on the producer installation) vital instruments which must be seen as an adjustment is being made are placed at the most useful position.

Improved operating conditions are promoted by the great width of the retort house; the spacing of the retorts; and execution of the top platform in chequer plate coupled with a wide vent extending the length of each side of the retort house. Coal tippling, though within the retort house, is separated from the settings by a partition wall. The inclusion of vent pipes extending through the coal bunkers are included and high roofing together with ventilated dormers is provided.

Consideration is now being given to the installation of a liquid purification system.

The culmination of six years' effort is in sight. At the time of writing, the whole of the gas stream plant is at work. Teething troubles have occurred and are occurring, but have been and are being overcome. I feel that the resulting installation will contain these desirable features: Economic efficiency of operation throughout the whole plant; reduced heavy manual labour; excellent working conditions within the retort house; flexibility of operation.

DISCUSSION

Mr. J. Foxton (Cheltenham) commented that, in regard to the provision of plate glass windows in Livesey washers, his experience was that they did not remain clean for long. On the question of fuel to producers, and the selection of the size of 2 in.-1¼ in. coke, he wondered whether consideration had been given to the fact that the sale of this size of coke

GAS SERVICE POCKET BOOK, 1952

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brought the best return. Also he would like to know what happened to the material below 1¼ in. No mention had been made of steam produced and obtained from the producers. He noticed that air to purifiers was controlled automatically by flow recorders. This being the case, what adjustment was there in the event of variations in the H_2S content of the boxes? He was also struck by the number of automatic alarms incorporated in the plant, and he wondered whether there might be any clashing if a number went off simultaneously.

Mr. Sanders replied that the glass windows were kept clean by the constant stream of liquor projected on to them, and it was easy to see if any tar was present. He agreed that the decision to use the particular size of coke mentioned was unusual, but the object had been to ensure an unfailing supply of coke. The undersize material from the producer screens was re-screened and graded in the usual way. The producers generated 100% of their own steam for blast saturation, but when the steam turbine blower was in use, steam had to be supplied from the main steam system.

On the matter of air to purifiers, he had intended to convey that this was controlled, but not automatically; there was a flow indicator on the air line, but it was encumbent on the technical staff to exercise control of the purifiers. In regard to the alarms, each alarm was carefully sited to prevent confusion and had a distinctive note.

Mr. N. G. Earle (Cheltenham) referred to the shortness of the elevated sidings, and enquired whether a large amount of shunting was required when unloading coal.

Mr. Sanders answered that this had been considered and it was with that thought in mind that two wagon tipplers were installed. It had been discovered that only two shunts per day were necessary. At present only one tippler was in use, and even so excessive shunting was not in evidence. A capstan was used for handling the wagons on the siding, and the railway was so arranged thatt he trucks rolled away from the tippler after being tipped.

Mr. C. P. Astbury (Birmingham) asked if Mr. Sanders could give any idea of the efficiency of the dust extraction plant.

Mr. Sanders replied that he would rather leave this question until more experience of the working of the plant had been gained; at the moment the efficiency was well up to standard. He added that the Power-Gas Corporation was shortly to install an experimental type of dust extractor.

Mr. S. C. Crathorn (Birmingham) raised two points: (a) Assuming that the pressure condition of the retort offtake was controlled automatically, what effect did the cutting of the sector discharger have on the offtake pressure? (b) The stainless steel slip plate seemed too good to be true; how was it put in and out, and was it likely for anyone to be gassed or burnt in the process?

Mr. Sanders said that the foul gas offtake pressure condition was controlled by a Bryan Donkin governor; the effect of the cutting was not so marked as he was led to believe was the case with other plants, and it certainly had not presented any great trouble so far. Although the actual operation of the insertion of the slip plates in the producer main was completed without difficulty, the job had to be carried out under gaseous conditions using breathing apparatus for about half an hour while the bolts were being slackened off and re-tightened. The final result was perfect safety. No burning occurred provided there was full understanding between the producer operator and the retort house superintendent.

Mr. D. J. Ward (Birmingham) suggested that some trouble might be experienced with the reducing valves or turbines while running on back pressure steam, although this might not have become evident yet in view of the short time the plant had been at work. With the use of canal water, which was presumably fairly hard, what was the effect on the tubes of the condensers, and were any special arrangements made for the removing of scale apart from by hand? He asked whether the action of the sector discharger caused any vibration of the structure.

Mr. Sanders replied that the turbines were not originally designed to work against back pressure, but the manufacturers had stated that after minor modification they would be suitable for this work. One turbine had been stripped down but nothing faulty had been discovered. Canal water was used because of the extremely heavy cost of town water; no special arrangements, apart from routine auguring, were made for the cleaning of the condensers, which of the open top vertical tube type. The sector discharger did not cause any undue vibration because each ram was mounted on the bottom ironwork of the particular retort it served, and, therefore, the reaction of the thrust of the ram was taken up within the ironwork of the retort itself instead of the setting.

Mr. Foxton enquired about the calorific value of the gas produced by the new plant. If this was high, had any consideration been given to the use of producer gas as a diluent?

Mr. Sanders said that the original specification had given a calorific value of 480 and the plant was quite capable of producing that quality. No plans had been made originally for producer gas dilution but it was now under consideration.

Mr. F. Grocott (Birmingham), commenting on the steam position on the works, asked whether there were any solid fuel fired boilers. Regarding the maintenance of a pressure of 110 lb. per sq. in. in the retort house, this seemed to indicate that the pressure on the rest of the works was below this.

Mr. Sanders replied that the works pressure was usually in the region of 85-100 lb. per sq. in., and the surplus pressure valve maintained the pressure in the retort house at 110 lb. per sq. in. irrespective of the rest of the works. There were some solid fuel fired Lancashire boilers installed, and five of these were normally in use at one time. The output of steam from the new installation had levelled out considerably the steam pressure throughout the whole system.

Mr. L. H. Hardy (Birmingham) enquired if there was any way of getting the coal into the retort house off the stack other than by the shunting of trucks.

Mr. Sanders said that the only way of handling coal to and from stock was by grab crane into and out of trucks. There was, however, in the other retort house, a small internal stock from which coal could be fed to the retorts by way of an underground belt conveyor and then by an elevator.

Mr. K. Crane (Birmingham) wondered whether the sector discharger had reduced the amount of rodding. He also asked if there was any particular reason why the waste heat boiler had been fixed on the rodding stage. Were any of the mains overground ?

Mr. Sanders said that it was too early to compare the rodding of this new installation with older plants. So far, everything was all that could be desired. The fitting of the waste heat boiler on the rodding stage enabled the shortest route to be taken by the waste heat flues. The exhauster outlet ring-main was overground, but the inlet ring-main was underground.

Mr. W. A. Pask (Manager, Leicester and Rutland subdivision) gave additional reasons for the installation of the waste heat boiler above ground—namely, to conserve ground floor space; and, in view of the fact that it was not intended to maintain an individual waste heat boiler attendant, it was decided to put the boiler on the top stokers' landing, this being the only place where someone was in attendance for the whole 24 hours.

Mr. Bacon (Coventry) asked if any consideration had been given to the provision of tar extractors on the inlet to exhausters instead of outlet, and whether any thought had been given to hot de-tarring. In connection with the parallel scheme of inlet and outlet to exhausters, was there any noticeable hunting effect ?

Mr. Sanders said that no consideration had been given to the siting of the tar extractors on the inlet to exhausters, or to the use of hot de-tarring, as it was considered safer to have the tar extractors on the exhauster outlet. In regard to the hunting of the exhausters, normally the two streams were entirely separate, but during the one period, when the gas streams had been common, no hunting had been noticed. The exhauster governors were of normal design.

Mr. D. J. Ward (Senior Vice-President) proposed a vote of thanks to Mr. Sanders for his paper, and **Mr. W. A. Pask** seconded.

In the paper by Mr. Alec Hughes, Radiation (Large Cooking Equipment) Ltd., published in the *Journal* of December 5, 1951, a correction should be made in the last paragraph, right-hand column, p.631, the opening sentence of which should read: It is a help if the greatest volumes of fresh air be introduced in those places where excessive heat is likely to be felt.